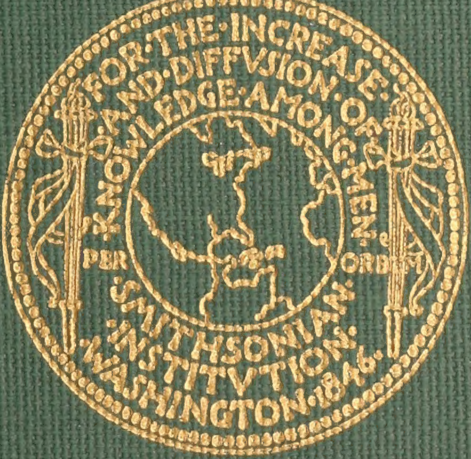
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MUSEUM OF NATURAL HISTORY

Marine Polychaete Worms of the New England Region

1. Families Aphroditidae Through Trochochaetidae

MARIAN H. PETTIBONE

SMITHSONIAN INSTITUTION

WASHINGTON, 1963

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FRANK A. TAYLOR
Director, United States National Museum

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Marine Polychaete Worms
# of the
New England Region

Part I

Families

Aphroditidae Through Trochochaetidae

Introduction

The polychaetes of the Atlantic coast of New England are still very imperfectly known. Situated as the region is, Arctic and Boreal faunal areas are represented, and a rich polychaete fauna, both in numbers of species and in numbers of individuals, is found there. The fauna has been made known in part chiefly by A. E. Verrill, H. E. Webster, J. E. Benedict, and J. Percy Moore. Some of the original descriptions of the species, however, were sketchy and poorly illustrated, in some cases confined to a footnote of a few lines. Some species were given names without distinguishing them clearly from those previously described.

An attempt to rectify these shortcomings was made by Dr. J. Percy Moore in the early 1900's. He prepared a manuscript on "The Polychaetous Annelids of the Woods Hole Region" (1,032 manuscript pages, 135 figures), based chiefly on collections made by the U.S. Fish Commission. Unfortunately, this manuscript was not published, but it is now deposited in the U.S. National Museum, and was consulted during preparation of the present work. Observations and figures taken from the manuscript are indicated by "Moore (MS.)".

Important faunal studies that include the polychaetes are those of F. B. Sumner, et al. (1913) on Woods Hole and vicinity, based on extensive collections by the U.S. Fish Commission (polychaete identifications in part by J. Percy Moore and A. L. Treadwell), and William Procter (1933) on the Mount Desert region (polychaete identifications in part by A. L. Treadwell). Valuable contributions were made by Dr. Olga Hartman after studying the types of polychaetous annelids at the Peabody Museum at Yale University (1942b), the U.S. National Museum (1942c), and the American Museum of Natural History (1944a). The last publication includes some of Verrill's previously unpublished plates of drawings made by J. H. Emerton.

The present study attempts to give as complete a representation of the New England polychaete fauna as is now possible, to systematize our knowledge of the polychaete species known from this portion of the American coast, and to furnish keys designed to facilitate their identification. Besides information gathered from the literature, the present work is based on the following:

(1) Field studies, including intertidal collecting and shallow dredging, conducted by the writer in the New England region. These studies were confined chiefly to the Woods Hole and Cape Cod region of Massachusetts; the New Hampshire coast and vicinity; and Maine and New Brunswick, especially the Boothbay Harbor region and northern Maine. During parts of five summers in the Cape Cod area, two of them devoted to intensive collecting, my work was aided by members of the Supply Department of the Marine Biological Laboratory of Woods Hole, especially Mr. Milton Gray, who collected a great wealth of material, and by members of the staff and students in the invertebrate and ecology classes at the Laboratory. Sporadic collecting during a couple of years in New Hampshire was aided by members of the staff and students in the summer invertebrate classes of the University of New Hampshire. Most of the work in Maine was done during the summer of 1955 and was aided by Dr. George M. Moore and members of the U.S. Fish and Wildlife Service at Boothbay Harbor. This material, as well as that mentioned below, has in large part been deposited in the U.S. National Museum.

(2) Collections from various sources, chiefly from the New England region: A sizable collection of polychaetes among the fouling organisms from the buoy surveys conducted by the late Dr. Louis W. Hutchins of the Woods Hole Oceanographic Institution; material gathered by *Albatross* III, chiefly from Georges Bank, received from Dr. Roland L. Wigley of the U.S. Fish and Wildlife Service, Woods Hole; material from Woods Hole and the Cape Cod area received from Dr. John Rankin, Jr.; collections made in Buzzards Bay by Dr. Howard Sanders and Dr. Nathan Riser; specimens from Nantucket Sound received from Mr. Thayer Shafer; material collected at the Narragansett Marine Laboratory, Rhode Island, by Dr. Donald Zinn, Mr. Alden P. Stickney, Mr. Louis D. Stringer, and Mr. Harry P. Jeffries; collections made by Mr. Anthony Ganaros of the Maine Department of Sea and Shore Fisheries; specimens from Mr. Robert Hanks and Mr. Louis Taxiarchis of the U.S. Fish and Wildlife Service, Boothbay Harbor; material collected in the Chincoteague Bay area of Maryland by Dr. Samson McDowell, Jr.; collections made at Cape Ann, Massachusetts, by Dr. Ralph W. Dexter; specimens from Woods Hole and Puerto Rico from Dr. M. Jean Allen; material from Sapelo Island, Georgia, received from Dr. John M. Teal; miscellaneous material from Dr. Robert Howard, Dr. Emery F. Swan, and Mr. W. L. Klawe; collections from the Canadian Atlantic coast, St. Lawrence estuary and Gaspé, Newfoundland, Cape Breton Island, Nova Scotia, and

Bay of Fundy from P. Brunel and others from the Station de Biologie Marine, Grande-Rivière, E. L. Bousfield from the National Museum of Canada, from the Nova Scotia Museum of Science, and the Royal Ontario Museum of Science; material from Mr. John L. Taylor, from Seahorse Key, Florida.

(3) Collections in the U.S. National Museum. Nearly 3 years were spent at the Museum, working over the material referred to above and examining comparative material. In addition to the valuable cataloged and type specimens deposited in the Museum, a good deal of unidentified material from various sources was available for study, including some collected by the U.S. Fish Commission vessels *Albatross* and *Fish Hawk* off the east coast of North America, chiefly between 1883 and 1921; these collections had been only partly worked up by A. E. Verrill, A. L. Treadwell, J. Percy Moore, and others.

The polychaete taxonomy has been revised to a limited extent. For each genus, the original reference and type species are given and have been checked, except for those indicated as "not seen" in the list of references. Among the factors causing particular confusion in polychaete taxonomy, as with many other groups, are the continued use of a generic name even though preoccupied, the use of a generic name in a different sense from that indicated by the type species, the type designation of a species not included when the genus was proposed, use of a different spelling from the original, and failure to use the name of the oldest synonym.

As a result of this first part of the study, 12 new species are described (Pettibone, 1955, 1956b, 1957a–c), and a new family, Paralacydoniidae, and a new family name, Trochochaetidae (=Disomidae), are proposed. Part I includes 183 species belonging to 29 families. In order to facilitate identification, keys to the families, genera, and species are given, as well as synopses of the families. All species are figured in part. Most of the illustrations were drawn under the writer's direction, many of them from living material, by Mrs. Marie Litterer. Figures 1 and 2 were drawn by Mr. Lawrence Isham. Some figures were prepared from the writer's sketches and some from the unpublished manuscript of J. Percy Moore. An explanatory key to the lettering on the figures is given on page 6. The synonymies listed are by no means complete, but they bring together the important references to additional descriptions and figures and to ecological, embryological, and distributional references and records. The treatment otherwise includes a brief description of each species, notes on the biology of most of the species, an indication of the material examined, and the known geographic and bathymetric limits of each species.

This study was aided by grants from the National Science Foundation (NSF G–526, G–2012, G–4833) and from the Central University Research Fund of the Graduate School of the University of New Hampshire (CURF–50). The writer acknowledges her appreciation to the National Science Foundation for continued support on the project; to the University of New Hampshire for both support and leave time, and particularly to Dr. George M. Moore, whose interest and help throughout the project have been invaluable; and to the authorities of the U.S. National Museum for allowing her to make use of the facilities of the Institution, and especially to Dr. Fenner A. Chace, Jr., and Dr. Frederick M. Bayer for their help on taxonomic and other problems, to Mrs. Lanelle Peterson for her help in uncovering many rare "gems," to Dr. Waldo L. Schmitt for his enthusiastic prodding, and to the librarians for their invaluable aid in helping to obtain necessary and often difficult-to-find literature.

It is my hope that the second and concluding part of this study will be completed in the next few years.

Explanation of Symbols on Figures

The explanation of letter symbols on figures follows. Roman numerals indicate body segments (in Phyllodocidae), areas of proboscis (in Nereidae and Goniadidae), and maxillary jaw pieces (in Eunicea).

a C, anal cirrus
a K, achaetous knob
a La, anterior lamella
a P, anal or pygidial plate
ac, aciculum
ac L, acicular lobe
ac S, acicular seta
ai, aileron or wing on jaw
an, antenna
br, branchia
bu S, buccal segment
c G, chromophile gland
c P, cephalic peak of prostomium
ca, capsule
car, caruncle
cer, ceratophore or base of antenna
ch, chevron
cph, cirrophore or base of dorsal cirrus
cr, crotchet
ct, ctenidium or ciliated cushion
D, dorsal
d C, dorsal cirrus or notocirrus
d La, dorsal lamella
d T, dorsal tubercle of cirrigerous or non-elytra-bearing segment
D t C, dorsal tentacular cirrus
el, elytron or scale
elph, elytrophore
ey, eye
de R, denticled rim or margin
f An, frontal antenna
f Tu, facial tubercle
gl, gland
h G, hyaline gland
int C, interramal cirrus or intercirrus
j, jaw
l An, lateral antenna
li, ligule
lo, lobe
m, mouth
m An, median antenna
m C, maxillary carriers
m Pa, median papilla
m R, maxillary ring
ma G, macrognath
man, mandible
max, maxilla
mi G, micrognath
ne, neuropodium or ventral ramus of parapodium

ne C, neuropodial cirrus
ne Li, neuropodial ligule
ne S, neurosetae
no, notopodium or dorsal ramus of parapodium
no Li, notopodial ligule
no S, notosetae
nu E, nuchal epaulette
nu F, nuchal fold
nu H, nuchal hood
nu O, nuchal organ
nu T, nuchal tubercle
oc An, occipital antenna
oc P, ocular peduncle
o R, oral ring
ov, ovary
p La, posterior lamella
pa, palp
pap, papilla
pi, pinnule
post L, postsetal lobe or lip
post Pap, postsetal papillae or podial fringe
pr, prostomium
pre L, presetal lobe or lip
prob, proboscis
prob O, proboscideal organs
ro, rosette organ
s S, swimming setae
sem R, seminal or sperm receptacle or pouch
set, setigerous segment or "setiger"
set Lo, setigerous lobe
st, style of dorsal cirrus
sty, stylodes of parapodia or parapodial fringe
sub F, subpodal flange or ventral pad
sub Pap, subpodal lateral papilla or ventral cirrus
t C, tentacular cirrus
t S, tentacular segment
t Pa, tentacular palp
to, tooth
V, ventral
v C, ventral cirrus or neurocirrus
v Pap, ventral or stomach papillae or ventral fringe
V t C, ventral tentacular cirrus

Class Polychaeta

Key to the Families of Polychaeta from New England: Aphroditidae through Trochochaetidae

1. Body transparent. Exclusively pelagic 2
Body opaque. Not exclusively pelagic 4

2. Parapodia uniramous; with foliaceous dorsal and ventral cirri. Eyes enormous or absent 3
Parapodia biramous, each ramus bordered by flattened finlike membranes or pinnules, without external setae; without dorsal and ventral cirri. Prostomium and fused tentacular segment with a pair of small eyes, a pair of diverging, flattened anterior antennae or frontal horns, and a large pair of tentacular cirri (figs. 24, 25) . . . . **Tomopteridae** (p. 94)

3. Prostomium small, suboval, with 4–5 antennae, with a pair of enormous spherical eyes with globular lenses. Parapodia well developed with setae numerous, long, capillary (figs. 22, 23) . . . . **Alciopidae** (p. 91)
Prostomium conical, without antennae, with prominent nuchal organ, without eyes. Parapodia vestigial with setae lacking or with few short acicular setae (fig. 26) . . . . **Typhloscolecidae** (p. 98)

4. With projecting parapodial setal lobes supported by internal acicula . . 5
Without projecting parapodial setal lobes, without internal acicula; parapodia biramous, with conical or filiform postsetal notopodial lobes, with or without neuropodial postsetal lobes; setae simple. Prostomium subconical, with pair of nuchal organs. Without tentacular cirri or tentacular palps. Branchiae dorsal to notopodia, simple, straplike or wide

foliaceous. Proboscis saclike, unarmed (bottom-deposit feeders). Live in mud or sand with tubes of mucus plus sand or mud (figs. 79–81). **Paraonidae** (p. 298)

5. Proboscis eversible, unarmed, saclike, used in burrowing and feeding (bottom-deposit feeders). Body divided into 2–3 regions with parapodia differing markedly 6

Proboscis variable, not saclike. Body with parapodia similar along body, at least not divided into distinct regions (except sometimes in sexual epitokous stages and in Goniadidae, which has anterior uniramous and posterior biramous regions) 8

6. Body divided into 3 regions. Prostomium more or less fused with buccal segment, with pair of long, longitudinally-grooved, spioniform tentacular palps (deciduous, may be missing) 7

Body divided into (1) anterior thoracic region with parapodia lateral and (2) posterior abdominal region with both neuropodia and notopodia directed dorsally, with ligulate postsetal lobes. Branchiae dorsal to notopodia, simple (rarely branched), straplike (postsetal lobes and branchiae give straggly, slashed aspect to abdominal region). Parapodia biramous. Prostomium subconical, subglobular or spatulate; without appendages; with pair of inconspicuous nuchal organs; without tentacular palps (figs. 74–76) . . . . **Orbiniidae** (p. 276)

7. Prostomium and fused buccal segment subconical to suboval, with pair of nuchal folds. Parapodia subbiramous, with notopodia cylindrical, with internal acicula only, without notosetae (figs. 77, 78). **Apistobranchidae** (p. 295)

Prostomium elongate-oval, wedged between first 2 setigers. Parapodia biramous, with notosetae (except in middle uniramous region) (figs. 82, 83). **Trochochaetidae, New Name** (p. 308)

8. Without dorsal scales or elytra 11

With dorsal scales or elytra on certain segments, more or less covering dorsum (elytra may be hidden by dorsal feltage of capillary notosetae in some Aphroditidae) . . superfamily APHRODITOIDEA 9

9. With filiform dorsal cirri on non-elytra-bearing segments 10

Without dorsal cirri (except sometimes on setiger 3) (figs. 10, 11). **Sigalionidae** (p. 45)

10. First or tentacular segment with numerous setae. Facial tubercle well developed. Dorsal feltage more or less concealing elytra (figs. 1, 2). **Aphroditidae** (p. 11)

Tentacular segment with setae few or lacking. Facial tubercle poorly developed or lacking. Dorsal feltage lacking (figs. 3–9) . . **Polynoidae** (p. 15)

11. Dorsal surface convex, bristly, formed by elongated transverse notopodial or dorsal setigerous lobes nearly covering dorsum, with numerous spinelike notosetae in transverse rows 12

Dorsal surface otherwise 13

12. Neuropodia not sharply set off from notopodia, with numerous simple neurosetae (fig. 14) . . . . **Euphrosinidae** (p. 62)

Neuropodia cylindrical, sharply set off from notopodia, with 1 or few compound hooked neurosetae. Associated with sponges (fig. 15). **Spintheridae** (p. 66)

13. Body without spherical capsules. Prostomium distinct. Segmentation distinct 14

Body with 2 or more rows of large spherical capsules, segmentally arranged. Prostomium and tentacular segment indistinct. Segmentation indistinct except as marked by parapodia. Parapodia uniramous. Body covered with papillae (fig. 52) . . . . **Sphaerodoridae** (p. 205)

14. With dorsal cirri posterior to lateral fanlike tufts of notosetae 15

Dorsal cirri lacking or otherwise 16

15. Notosetae in lateral tufts curving dorsally and forming fan-shaped groups or transverse rows. Neurosetae compound. Without branchiae (fig. 12). **Chrysopetalidae** (p. 54)

Notosetae extending laterally. Neurosetae simple. With paired branched branchiae posterior to bases of notopodia on certain number of segments (fig. 13) . . . . **Amphinomidae** (p. 55)

16. Dorsal and ventral cirri, if present, not leaflike or globular 17

Dorsal and ventral cirri flattened, leaflike or more or less globular. Prostomium with 4–5 antennae. Tentacular cirri 2–4 pairs. Parapodia uniramous (exceptionally subbiramous); setae compound (figs. 16–21). **Phyllodocidae** (p. 68)

17. Prostomium conical, annulated, ending distally in 4 minute antennae. Peristomium fused with prostomium, without tentacular cirri. Large powerful proboscis. Burrow in sand or mud . . superfamily GLYCEREA (p. 209) . 18

Prostomium otherwise 19

18. Body with parapodia similar, either all uniramous or all biramous. Dorsal cirri small, globular; ventral cirri larger, conical. Proboscis with 4 subequal jaws or macrognaths (figs. 53–55) . . . . . . **Glyceridae** (p. 209)

Body divided into 2–3 regions: (1) anterior region with uniramous parapodia; (2) transitional region in which notopodia develop gradually (may be lacking); (3) posterior biramous region with rami well separated. Both dorsal and ventral cirri conical to ligulate. Proboscis with pair of dentate macrognaths and variable number of micrognaths (figs. 56–59). **Goniadidae** (p. 218)

19. Body subrectangular in cross-section. Biramous parapodia with rami well separated and with long cilia along interramal border; notosetae and neurosetae arranged in fan-shaped bundles, with more or less developed presetal and postsetal flattened plates or lamellae. Prostomium flattened, shield shaped, subconical to subrectangular, with 4 small antennae. Burrow in sand or mud. 20

Body, parapodia, and prostomium otherwise. 21

20. Tentacular or buccal segment with notosetae and neurosetae, with pair of small ventral tentacular cirri. Neurosetae simple (figs. 47–51). **Nephtyidae** (p. 186)

Tentacular or buccal segment achaetous, without tentacular cirri. Neurosetae compound (fig. 46) . . . **Paralacydoniidae, new family** (p. 184)

21. With 1–2 achaetous and apodous tentacular or buccal segments, without tentacular cirri (or with only a single short laterodorsal pair). With elaborate dark chitinous jaw apparatus consisting of pair of ventral mandibles and more dorsal maxillae consisting of few to numerous paired pieces . . superfamily EUNICEA (p. 229) 22

With 1–8 pairs lateral tentacular cirri. Jaws absent or otherwise . . . 26

22. Prostomium simple conical or suboval, without antennae or distinct palps. Parapodia without dorsal or ventral cirri. First 2 segments achaetous and apodous, without tentacular cirri. Body smooth, elongate, cylindrical, resembling an earthworm. Burrowing, carnivorous 23

Prostomium suboval, with 1–7 antennae, 2 palps (latter may be rather indistinctly separated from prostomium). Parapodia with subulate to cirriform dorsal and ventral cirri (latter may be thickened, padlike in more posterior segments). Body otherwise 24

23. Neurosetae consisting of: (1) Limbate setae with fine tips and (2) hooded hooks or crotchets (figs. 67–70) . . . . **Lumbrineridae** (p. 256)

Neurosetae consisting of limbate setae and with or without projecting acicular setae; without hooded hooks or crotchets (figs. 71–73). **Arabellidae** (p. 268)

24. First 2 segments apodous and achaetous 25

First apparent segment apodous and achaetous. Prostomial antennae 7 (5 long occipital, 2 short frontal); paired ventral palps short, globular. Tube dwelling (figs. 64–66) . . . . **Onuphidae** (p. 243)

25. Prostomium with pair of articulated antennae and pair of long curved ventral palps (or both short, subequal in *Ophryotrocha*). Crawling or burrowing (figs. 60, 61) . . . . **Dorvilleidae** (p. 230)

Prostomium with 1–5 occipital antennae and a pair of short globular ventral palps more or less fused to prostomium. Tube dwelling (figs. 62, 63). **Eunicidae** (p. 234)

26. Neurosetae compound (some may have blades secondarily fused to shafts in some Syllidae) 27

Neurosetae and notosetae simple, not compound (notosetae may be stout, hooked). Tentacular segment apodous and achaetous, more or less fused with prostomium, usually with 2 pairs of small tentacular cirri (fig. 30). **Pilargiidae** (p. 110)

27. Parapodia biramous or subbiramous; notopodia at least represented by internal acicula 28

Parapodia uniramous (may be biramous in sexual epitokes). Tentacular segment apodous and achaetous, with 1–2 pairs of tentacular cirri. Prostomium suboval with 3 antennae, 2 palps (latter may be reduced and fused) (figs. 31–40) . . . . **Syllidae** (p. 112)

28. Parapodia with varying degrees of development of extra tonguelike lobes or ligules (may be lacking, as in *Lycastopsis*). Prostomium suboval to subpyriform, with 2 frontal antennae and 2 biarticulate palps. Proboscis with pair of distal dentate hooked jaws. With single apparent tentacular segment with 3–4 pairs tentacular cirri. Notosetae compound (may be lacking, as in *Lycastopsis*) (figs. 41–45) . . . . **Nereidae** (p. 148)

Parapodia without ligules (may have extra lobes, as in *Nereimyra*). Prostomium suboval to subquadrangular, with 2–3 antennae, 2 palps (may be biarticulate). Proboscis without jaws or jaws otherwise. With 1–4 achaetous tentacular segments more or less distinct, with 2–8 pairs tentacular cirri. Notosetae simple or lacking (figs. 27–29). **Hesionidae** (p. 101)

Superfamily Aphroditoidea

Members of this superfamily possess paired dorsal scales or elytra borne on cylindrical stumps, the elytrophores, on a certain number of segments (fig. 3,*a*–*b*; in Aphroditidae, elytra may be hidden under dorsal feltage consisting of modified notosetae). Prostomium distinct, bearing 1 to 3 dorsal antennae, a pair of elongated conical ventral palps, and usually 2 pairs of eyes (0–2 pairs). First or tentacular segment with 2 pairs of tentacular cirri, with or without setae. Parapodia biramous, with or without filiform dorsal cirri on segments bearing no elytra, with short subulate ventral cirri. Pygidium usually with a pair of anal cirri. Eversible muscular pharynx, with soft sensory papillae around opening and usually with 2 pairs of chitinous jaws (rudimentary in Aphroditidae, fig. 3*c*). Carnivorous.

Included are the families Aphroditidae, Polynoidae, and Sigalionidae (see the key to the families, p. 8), sometimes considered subfamilies of the family Aphroditidae.

Family Aphroditidae

Body relatively short and broad, oval or spindle shaped. Segments few in number (less than 60). Elytra 15 to 20 pairs, large, overlapping. With dorsal cirri on segments without elytra. Notosetae consisting of capillary setae which may extend dorsally, forming a feltage (feltage composed of the fine capillary setae combined with mucus, mud, sand, and debris) and large, brownish protective spines Ventral surface and parapodia covered with globular papillae. First or tentacular segment with numerous setae. Prostomium spherical, usually with median antenna only. Facial tubercle well developed. Proboscis large and powerful, lacking jaws or jaws rudimentary. Usually found in mud.

Key to the New England Genera of Aphroditidae

1. Dorsal feltage loose, more or less developed, usually not covering elytra completely (may be absent). Large dark notosetae with tips barbed (harpoon shaped, fig. 1*c*). Neurosetae with unilateral fringe and a basal spur (fig. 1*d*). Prostomium with ocular peduncles, with or without pigment or eyes (fig. 1*a*) . . . . **Laetmonice**

   Dorsal feltage a thick tangled matting completely covering the elytra (fig. 2,*a–b*). Large dark notosetae without barbed tips. Neurosetae pointed to slightly hooked, without unilateral fringe or basal spur. Prostomium without ocular peduncles; eyes, when present, sessile (fig. 2*c*) . **Aphrodita**

Genus *Laetmonice* Kinberg, 1855

Type (monotypy): *Laetmonice filicornis* Kinberg, 1855. Contains only one New England species.

Laetmonice filicornis Kinberg, 1855

FIGURE 1

Laetmatonice armata Verrill, 1879, p. 168; 1881, pp. 297, 303, 307, 311, 319, 320, pl. 6, fig. 6, *a*, *b*.—Webster and Benedict, 1887, p. 708.—Miner, 1950, p. 308, pl. 100.

Laetmonice filicornis Moore, 1903a, p. 420; 1909a, p. 137.—Hartman, 1942a, p. 90.—Treadwell, 1948, p. 11, fig. 2*b*.—Eliason, 1962, p. 213.—Wesenberg-Lund, 1950b, p. 11; 1951, p. 7.—Miner, 1950, p. 308, pl. 101.

Laetmatonice filicornis Fauvel, 1923, p. 36, fig. 12, *a–f*.—Støp-Bowitz, 1948a, p. 8.

Description.—Length up to 90 mm., width including setae up to 45 mm., segments 33–42. Dorsum more or less covered with grayish felt composed of feltage notosetae, mucus and mud; the sides are flanked by the large iridescent brownish setae. Elytra usually 15 (14–18) pairs, smooth, deeply notched on the outer attached borders. Median antenna, tentacular cirri, and dorsal cirri long, filiform, in-

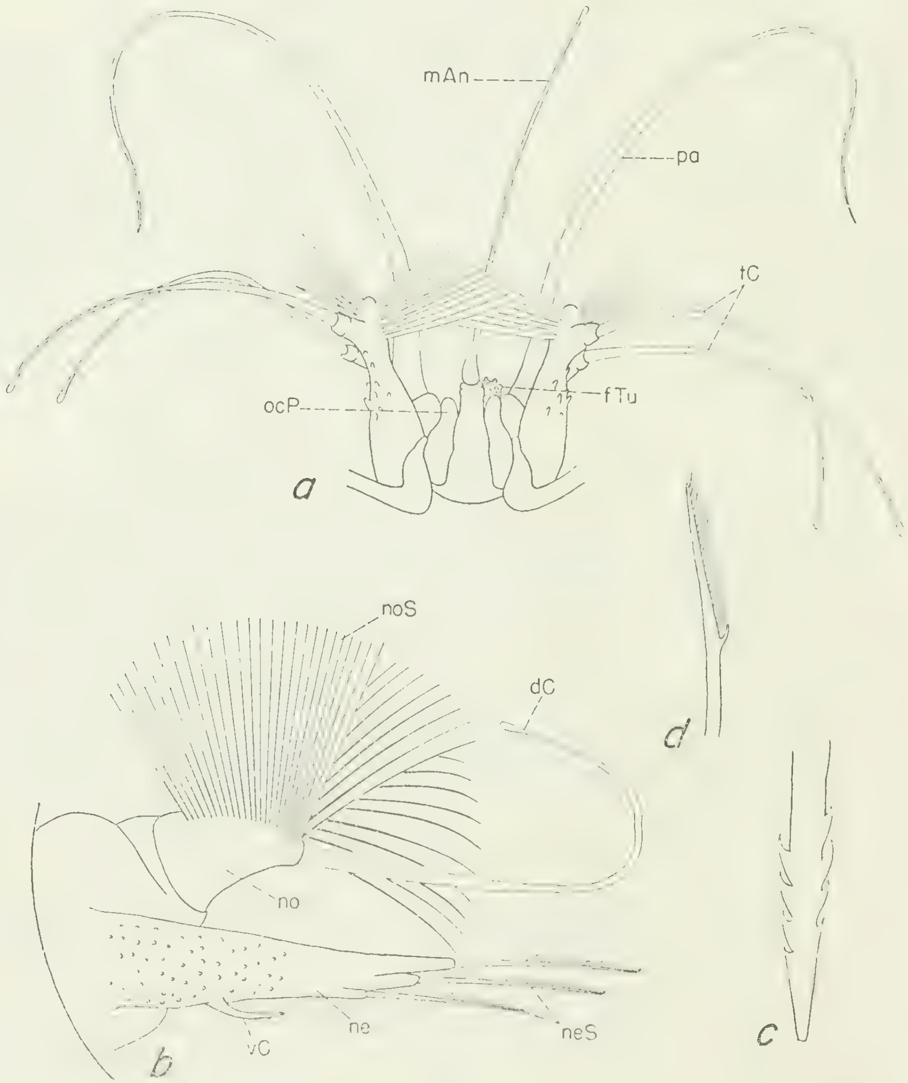

Figure 1.—Aphroditidae, *Laetmonice filicornis: a*, dorsal view prostomium and tentacular segment; *b*, parapodium of cirrigerous segment; *c*, tip of notoseta showing barbs; *d*, neuroseta showing basal spur and unilateral fringe.

flated at the tips. Prostomium with nonpigmented ocular peduncles. Neuropodium long, slender, with few stout brownish neurosetae arranged in three rows. Notosetae of cirrigerous segments composed of several divergent clusters of light-colored transparent capillary setae, some rather thick basally.

On elytragerous segments, notosetae composed of: (1) Fan-shaped upper group of light yellow, slender setae with capillary tips, the feltage setae; (2) fan-shaped lower group of stout, dark-brownish, spinelike protective setae with pointed harpoon-shaped tips with several recurved barbs (fig. 1*c*); (3) groups of fine capillary setae arranged basally and ventrally to the stout protective setae.

BIOLOGY.—Dredged on bottoms of mud and fine sand, often at considerable depths. Restricted mostly to the open sea. Taken from the stomach of the tile fish (Moore, MS.).

MATERIAL EXAMINED.—Numerous specimens from off Newfoundland and south of Anticosti Island in Gulf of St. Lawrence to off North Carolina, in 19 to 2,620 fathoms.

DISTRIBUTION.—Davis Strait and west Greenland, Iceland, North Atlantic to West Indies, Gulf of Mexico, Australia. In 19 to 2,620 fathoms.

Genus *Aphrodita* Linné, 1758

Type (designated by Malmgren, 1867, p. 3): *Aphrodita aculeata* Linné, 1758. Contains only one New England species.

Aphrodita hastata Moore, 1905

FIGURE 2

Aphrodite aculeata Verrill, 1881, pp. 288, 290, 297, 300, 303, 306, 307, 311, 323, pl. 3, fig. 1.—Not *A. aculeata* Linné, 1758.

Aphrodita aculeata Webster and Benedict, 1884, p. 699; 1887, p. 708.—Treadwell, 1948, p. 12, fig. 2*c*.—Not *A. aculeata* Linné, 1758.

Aphrodita hastata Moore, 1905, p. 294, figs. 1–4.—Sumner, Osburn, and Cole, 1913, p. 619.—Procter, 1933, p. 136.—Pratt, 1951, p. 327, fig. 488.

DESCRIPTION.—Length up to 150 mm. (up to 230 mm., Procter, 1933), width including setae up to 75 mm., segments 40-41. Dorsum completely covered with a grayish feltage composed of a tangled mass of capillary notosetae and mud. Elytra 15 pairs, large, smooth. Prostomium with short median antenna and pair of sessile pigmented areas. Neuropodium stout, with light to dark amber-colored neurosetae arranged in three rows; neurosetae stout basally, tapering gradually to sharp tips (may be blunt due to wear).

Notopodium bearing 3 kinds of setae: (1) Lateral group of highly iridescent capillary setae, yellowish (in younger individuals) to reddish bronzy (in larger individuals; in *A. aculeata*, this group is bronzy

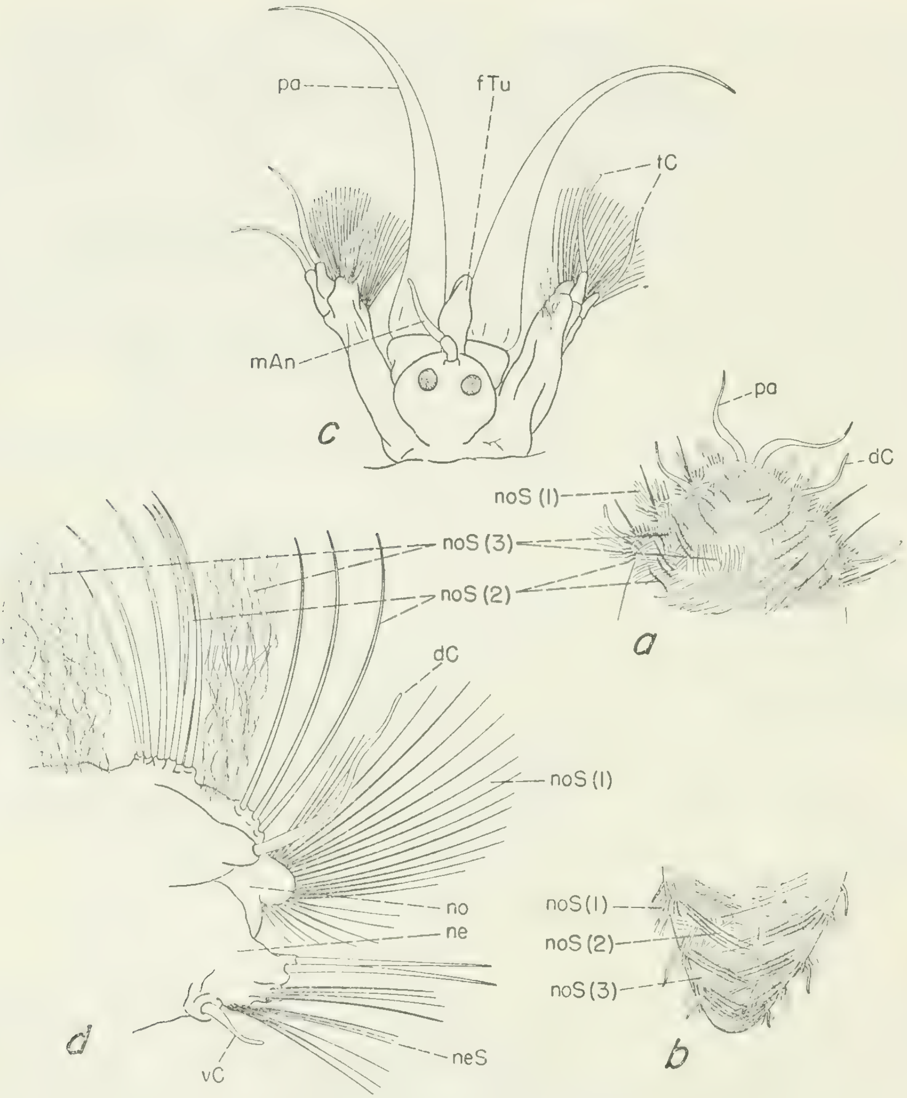

FIGURE 2.—Aphroditidae, *Aphrodita hastata: a*, dorsal view anterior end; *b*, dorsal view posterior end; *c*, dorsal view prostomium and tentacular segment; *d*, parapodium of cirrigerous segment.

basally and brilliant bluish green distally). (2) An upper and lower tuft of large, dark amber-colored protective notosetae; they extend dorsomedially, perforating the dorsal feltage, nearly touching medially and especially conspicuous in the posterior fourth; they are stout basally, tapering gradually to slender, flexible hooked tips (may be broken off; in *A. aculeata*, these protective spines are thicker, darker, much shorter, acute and rigid, projecting stiffly along the lateral part of the body and leaving the greater part of the dorsum free of these heavy spines). (3) Groups of fine, capillary, iridescent, yellowish feltage setae in 2 main groups on the cirrigerous segments, 1 above and 1 below the upper tuft of protective notosetae, and 1 large group between the 2 groups of protective setae on the elytragerous segments; the feltage setae extend dorsally forming a tangled continuous mat covering the elytra and penetrated by the protective setae.

Biology.—Popularly known as the sea mouse. A dredged form, sometimes washed up on the beach after a storm. Found on bottoms of mud and on mixed bottoms containing much mud; sometimes found in lobster pots. Specimens taken from the stomach of haddock (off Chatham, Massachusetts, July 6, 1956, E. Clark, collector; and Georges Bank, February 3, 1955, R. Wigley), from the stomach of a cod, *Gadus callarias* (Miscou Bank, Gulf of St. Lawrence, May 27, 1953). Adults filled with mature eggs and sperm in August (Gulf of Maine, Procter, 1933).

Material examined.—Numerous specimens from Gulf of St. Lawrence, Grand Banks off Newfoundland to off mouth of Chesapeake Bay, in 12 to 1,106 fathoms.

Distribution.—Gulf of St. Lawrence to Chesapeake Bay. In 2 to 1,106 fathoms.

Family Polynoidae

Body relatively short or long and vermiform. Elytra not concealed under feltlike setae. With dorsal cirri on segments without elytra. Pygidium with a pair of anal cirri. First or tentacular segment with setae few or lacking. Prostomium bilobed, usually 2 pairs of eyes, 3 antennae, a pair of palps. Facial tubercle poorly developed. Ventral surface without numerous globular papillae. Proboscis large, powerful, distally with 2 pairs of amber-colored interlocking jaws and a circle of papillae (fig. 3*c*). Characteristically crawling forms. May live commensally with other animals.

Key to the New England Genera of Polynoidae

1. Lateral antennae inserted terminally on anterior prolongations of the prostomium, without distinct ceratophores (fig. 3*b*). Elytral pairs 12–13, 17–20, or numerous 2
Lateral antennae inserted ventral to median antenna, with ceratophores more or less distinct (fig. 7*a*). Elytral pairs 15–16 5
2. With notosetae; notosetae finer than neurosetae 3
Without notosetae 4
3. Segments few (26); elytral pairs 12. . . . . **Lepidonotus** (p. 16)
Segments numerous (more than 50); elytral pairs numerous (more than 23). **Lepidametria** (p. 19)
4. Segments 36–39; elytral pairs 17–20. Notopodia represented by a fingerlike lobe with an embedded aciculum (fig. 4*g*). Nonpelagic. **Alentiana** (p. 20)
Segments 26–27; elytral pairs 12–13. Notopodia lacking entirely. Pelagic. **Drieschia** (p. 22)

5. At least some of the notosetae with slender capillary tips or notosetae more slender than neurosetae 6
   Notosetae stouter than neurosetae, with well marked spinous rows and smooth blunt to pointed tips (fig. 7*c*). 9
6. Segments more than 45. Elytra on anterior part of body only, leaving posterior part uncovered . . . . **Enipo** (p. 22)
   Segments about 40. Elytra cover dorsum 7
7. Neurosetae with slender sharp tips, not hooked (fig. 4*f*). . **Hartmania** (p. 25)
   At least some of neurosetae with hooked tips 8
8. Neurosetae of 2 forms, some with slender sharp tips and some with bifid tips (fig. 6,*j–k*) . . . . **Arcteobia** (p. 27)
   Neurosetae with entire tips (fig. 5,*c–d*) . . . . **Gattyana** (p.28)
9. Neurosetae long, slender, at least some end in capillary tips. **Antinoëlla** (p. 30)
   Neurosetae stouter, with tips straight or slightly hooked, not capillary. . 10
10. Neurosetae with hairs on distal tip (fig. 4,*c–d*). . . . **Austrolaenilla** (p. 32)
   Neurosetae without hairs 11
11. Upper neurosetae with slender forked tips (fig. 4*b*). . . . **Eucranta** (p. 33)
   Neurosetae with tips bare, hooked (subgenus *Eunoë*, fig. 9*c*), with subterminal secondary tooth (subgenus *Harmothoë*, fig. 7*d*) or with secondary tooth present, rudimentary or absent (subgenus *Lagisca*). **Harmothoë** (p. 34)

Genus *Lepidonotus* Leach, 1816; emend. Malmgren, 1865

Type (designated by Malmgren, 1867, p. 4): *Lepidonotus squamatus* (Linné, 1758).

Both species represented have the body short, linear, of nearly uniform width, with 26 setigerous segments. Elytra 12 pairs, covering the dorsum; elytral surface studded with chitinous tubercles and lateral fringes of papillae (fig. 3,*a*,*d*,*e*). Antennae, tentacular and dorsal cirri with subterminal enlargements and dark bands on the enlarged parts. Notosetae spiny, finer and shorter than the neurosetae. Neurosetae stout, dark amber colored, with several rows of spines and smooth hooked tips (without secondary tooth).

Key to the New England Species of *Lepidonotus*

1. Elytral tubercles variable in size—larger and smaller, crowded, conical to low mounds (fig. 3*d*). Posterior pair of elytra notched medially (fig. 3*a*). Upper row notosetae shorter, ending in blunt tips, rest end in capillary tips. **L. squamatus**
   Elytral tubercles tiny, widely spaced (fig. 3*e*). Posterior pair of elytra nearly straight medially, not notched. All the notosetae end in capillary tips. **L. sublevis**

Lepidonotus squamatus (Linné, 1758)

FIGURE 3,*a–d*

Lepidonotus squamatus Verrill, 1881, pp. 288, 290, 291, 293, 294, 296, 300, 303, 306, 307, 313, 317, 321, 323, pl. 4, fig. 1, pl. 6, fig. 4.—Webster and Benedict, 1884, p. 699; 1887, p. 708.—Moore, 1909a, p. 136.—Sumner, Osburn, and Cole, 1913, p. 618.—Kindle, 1917, p. 150.—Fauvel, 1923, p. 45, fig. 16,*f–j*.—Not Treadwell, *in* Cowles, 1930, p. 341 (=*L. sublevis*).—Procter, 1933, p. 136.—Annenkova, 1937, p. 145; 1938, p. 129.—Treadwell, 1948, p. 14, fig. 4*a*.—Miner, 1950, p. 303, pl. 99.—Pratt, 1951, p. 327, fig. 449.—Wesenberg-Lund, 1951, p. 19; 1958, p. 26.—Berkeley and Berkeley, 1954, p. 455.—Newell, 1954, p. 333.—Uschakov, 1955, p. 126, fig. 20.—Costello, et al., 1957, p. 81.—Stickney, 1959, p. 16.—Clark, 1960, p. 10.—Eliason, 1962, p. 216.

Lepidonotus squamatus var. *angustus* Verrill, 1881, p. 300.

Lepidonotus caelorus Pettibone, 1953, p. 15, pls. 1, 2.

Description.—Length up to 50 mm., width up to 15 mm. Color: elytra exceedingly variable in coloration, mottled brownish or grayish, or uniformly tan with amber-colored, reddish, or greenish tubercles, with or without a row of bilateral darker spots.

Biology.—A slow moving polynoid that clings close to rough surfaces of stones, found under stones, hiding in cracks and crevices, in the interstices between mussels (as *Mytilus*), tunicates, barnacles, cavities of sponges, holdfasts of algae (as *Laminaria*), among calcareous encrusting algae, hydroids (as *Tubularia*, *Pennaria*). Found on piles and timbers of wharves, floats, bridges, buoys, etc. One of the most abundant polychaetes in the oceanographic fouling studies from the New England region. May be found in brackish waters (Wesenberg-Lund, 1958). According to Newell (1954), it is sometimes found in lugworm burrows. It is dredged in great numbers on variable mixtures of rocks, gravel, mud, with shells, bryozoan nodules, tunicates (as sandy *Amaroecium*), sand dollars, oysters, algae. It is rarely found in mud. When disturbed, it rolls up like a pill bug, depending on the tough dorsal scales for protection. It is tough and sturdy, not fragmenting easily or losing its scales readily as do some of the polynoids.

In the Woods Hole region, Massachusetts, the breeding season extends from the last two weeks of April through May (Mead, 1897, 1898; Bumpus, 1898a-c). In the Boothbay Harbor region, Maine, specimens were massed with sex products in June (June 24, 1955). Males gave off clouds of white sperm in April (Sea Point, Maine, April 3, 1954; Newcastle, New Hampshire, April 7, 1954). Males whitish, viewed ventrally; females, when filled with eggs, dark greenish drab.

Material examined.—Numerous specimens from Gulf of St. Lawrence, New Brunswick, Nova Scotia to Long Island Sound, intertidal to 134 fathoms.

Distribution.—One of the most abundant and generally distributed polynoid species in the North Atlantic and North Pacific, but not an Arctic form. Iceland, Faroes, Norway to France; Labrador, Gulf of St. Lawrence to New Jersey (Virginia?); Alaska to Mexico, Japan. In low water to 1,400 fathoms.

***Lepidonotus sublevis* Verrill, 1873a**

FIGURE 3*e*

Lepidonotus sublevis Verrill and Smith, 1874, pp. 26, 38, 103, 116, 128, 287, pl. 10, fig. 42.—Verrill, 1881, p. 300, pl. 4, fig. 2, pl. 6, fig. 3.—Sumner, Osburn, and Cole, 1913, p. 618.—Hartman, 1942b, p. 22, figs. 7–12; 1945, p. 10; 1951, p. 17.—Hedgpeth, 1950, p. 75.—Behre, 1950, p. 11.—Pratt, 1951, p. 328.

Lepidonotus variabilis Treadwell, *in* Cowles, 1930, p. 341.—Not *L. variabilis* Webster, 1879.

Lepidonotus squamatus Treadwell, *in* Cowles, 1930, p. 341.—Not *L. squamatus* (Linné, 1758).

DESCRIPTION.—Length up to 34 mm., width up to 10 mm. Elytral surface with scattered, widely spaced, conical microtubercles of nearly uniform size, appearing nearly smooth compared with *L. squamatus.* Color: elytra mottled with grayish, greenish, or reddish brown.

BIOLOGY.—The species appears to be rather rare, compared with *L. squamatus*, due in part perhaps to its commensalistic habits where it escapes notice. It is found living commensally in snail shells occupied by hermit crabs, as *Pagurus pollicaris* Say, the polynoids occupying the columella as well as the whorls of the shells (found by breaking the shells). In the Gulf of Mexico, it was found in old shells and on the lower surface of the sea pansy, *Renilla mülleri* Kolliker (Hedgpeth, 1950). It is found intertidally among oyster clumps and under stones. It is dredged on various types of bottoms, especially shelly.

MATERIAL EXAMINED.—Massachusetts (dredged in the hole, Woods Hole, in gastropod shells with hermit crabs, *Pagurus pollicaris* Say; Muskeget Channel, Mutton Shoal Buoy, 7–20 fathoms; Nobska, Woods Hole; Nantucket Sound, 10 fathoms), Rhode Island (Sakonnet, in shells of moon-snail and whelk; Greenwich Bay, summers 1951–52, A. D. Stickney), Delaware (Delaware Bay, 3 fathoms, with *Pagurus pollicaris*), Maryland (Chesapeake Bay, *Fish Hawk* Stations 8826, 8898, 8918, 8975, in 7.1 to 25.4 fathoms; Hardy's Hole, Public Landing, Rattlesnake Island, Rum Harbor on Assateague Island, all in Chincoteague Bay, S. McDowell), Virginia (near Robins Marsh, Chincoteague Bay), North Carolina (Beaufort, with *Pagurus pollicaris*, A. S. Pearse, 1946), South Carolina (Kiawah River, Mackays Creek near Chechersee River, *Fish Hawk*, 1891), Georgia (Sapelo Island), Florida (Seahorse Key, J. Taylor).

DISTRIBUTION.—A more southern species than *L. squamatus*, ranging from Massachusetts (Woods Hole region) south to Florida and in the Gulf of Mexico. Low water to 55 fathoms.

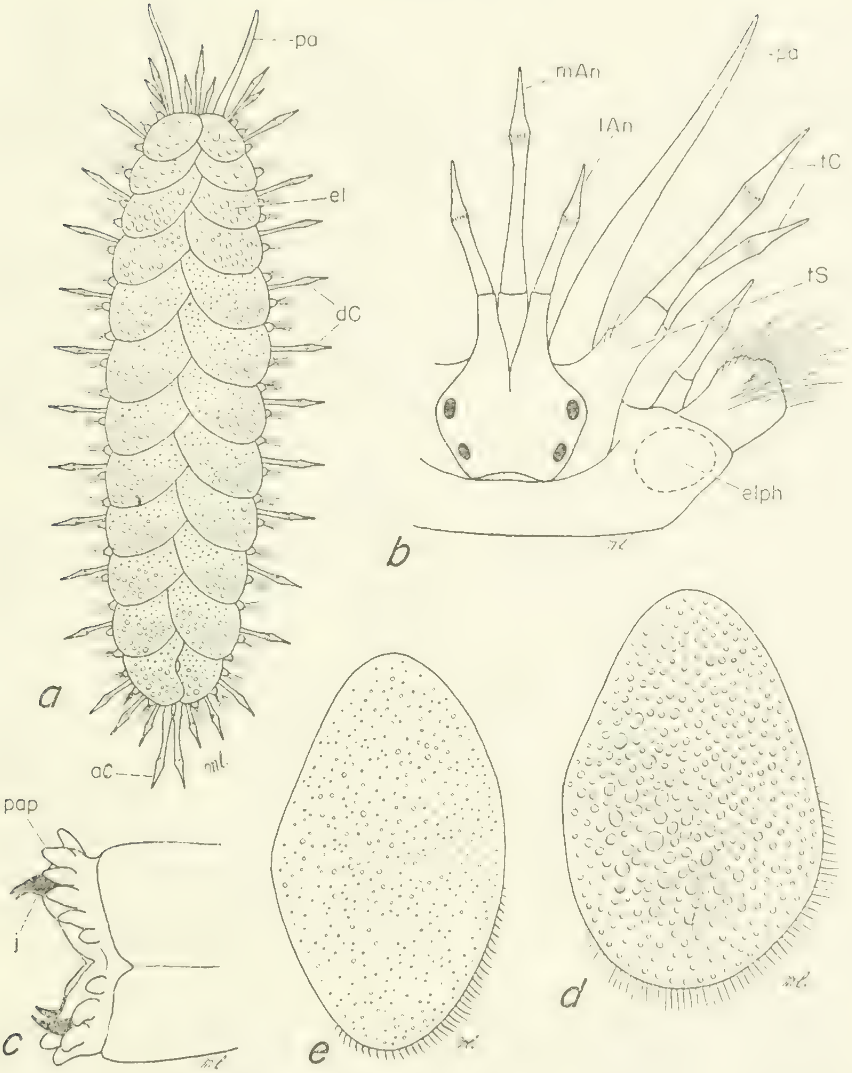

FIGURE 3.—Polynoidae, *a–d*, *Lepidonotus squamatus:* *a*, dorsal view; *b*, dorsal view prostomium and first 2 segments, elytra removed; *c*, lateral view distal tip of extended proboscis; *d*, sixth elytron. *e*, *Lepidonotus sublevis*, fifth elytron.

Genus *Lepidametria* Webster, 1879

Type (monotypy): *Lepidametria commensalis* Webster, 1879. Contains only one New England species.

Lepidametria commensalis Webster, 1879

FIGURE 4*k*

Lepidametria commensalis Webster, 1879, p. 210, pl. 3, figs. 23–31.—Webster and Benedict, 1884, p. 701.—Sumner, Osburn, and Cole, 1913, p. 618.—Hartman, 1945, p. 10; 1951, p. 17.—Miner, 1950, p. 304, pl. 99.
Lepidasthenia commensalis Hartman, 1959a, p. 85.

Description.—Length up to 100 mm., width including setae up to 9 mm., segments up to 80. Body elongated, vermiform, greatly flattened dorsoventrally. Elytra numerous pairs (30–50), continuing to near posterior end, oval, smooth, lacking tubercles and fringes of papillae, overlapping somewhat except medially where there may be a middorsal strip uncovered. The arrangement of the elytra in the posterior region is irregular, i.e., not always symmetrically paired, and as many as 7 elytra in a row. The elytra of young specimens have a peculiar conical raised area just medial to the elytrophores. Notosetae few, delicate, capillary. Neurosetae stout, bidentate, amber colored, the upper 1 or 2 stouter, darker and pointed. Color: body darkly pigmented reddish purple to dark gray or black; dorsal cirri with a dark subterminal band; elytra with small blotches of gray to black pigment with a lighter spot near the elytrophore.

Biology.—Active crawler, usually confined to the intertidal region, living commensally with other polychaetes, mostly terebellids. Found on flats of muddy sand and coarse gravel with mud, in the muddy tubes of the terebellid *Amphitrite ornata* Verrill (Massachusetts, Connecticut, New Jersey, Virginia, North Carolina), with the onuphid *Diopatra cuprea* (Bosc) (Beaufort, North Carolina, A. S. Pearse), with terebellid worms including *Thelepus setosus* (Quatrefages) (Florida, Hartman, 1951). Found among oysters (South Carolina). Shows some of the adaptations characteristic of polynoid tube-dwelling commensals, such as melanistic pigmentation, smooth elytra, extra heavy upper neurosetae which aid in crawling in the tube. Smaller specimens found in the tubes of *Amphitrite ornata* (some 45 segments, 23 pairs of elytra, Barnstable, August 23, 1954, and Duxbury, September 1, 1952).

Material examined.—Numerous specimens from Massachusetts (Annisquam River, Cape Ann, Duxbury, Barnstable, Wellfleet, Woods Hole region), Virginia (York River), North Carolina (Beaufort), South Carolina, Georgia (Sapelo Sound, 6–13 fathoms), and Florida, in low water.

Distribution.—Massachusetts (Cape Ann) to Florida and Gulf of Mexico (Florida, Louisiana, Texas). Low water to 13 fathoms.

Genus *Alentiana* Hartman, 1942b

Type (original designation): *Alentiana aurantiaca* (Verrill, 1885a). Contains only one New England species.

Alentiana aurantiaca (Verrill, 1885a)

Figure 4,*g–j*

Polynoë aurantiaca Verrill, 1885a, p. 525, pl. 40, fig. 173; 1885b, p. 425.
Alentiana aurantiaca Hartman, 1942b, p. 20, figs. 1–6.

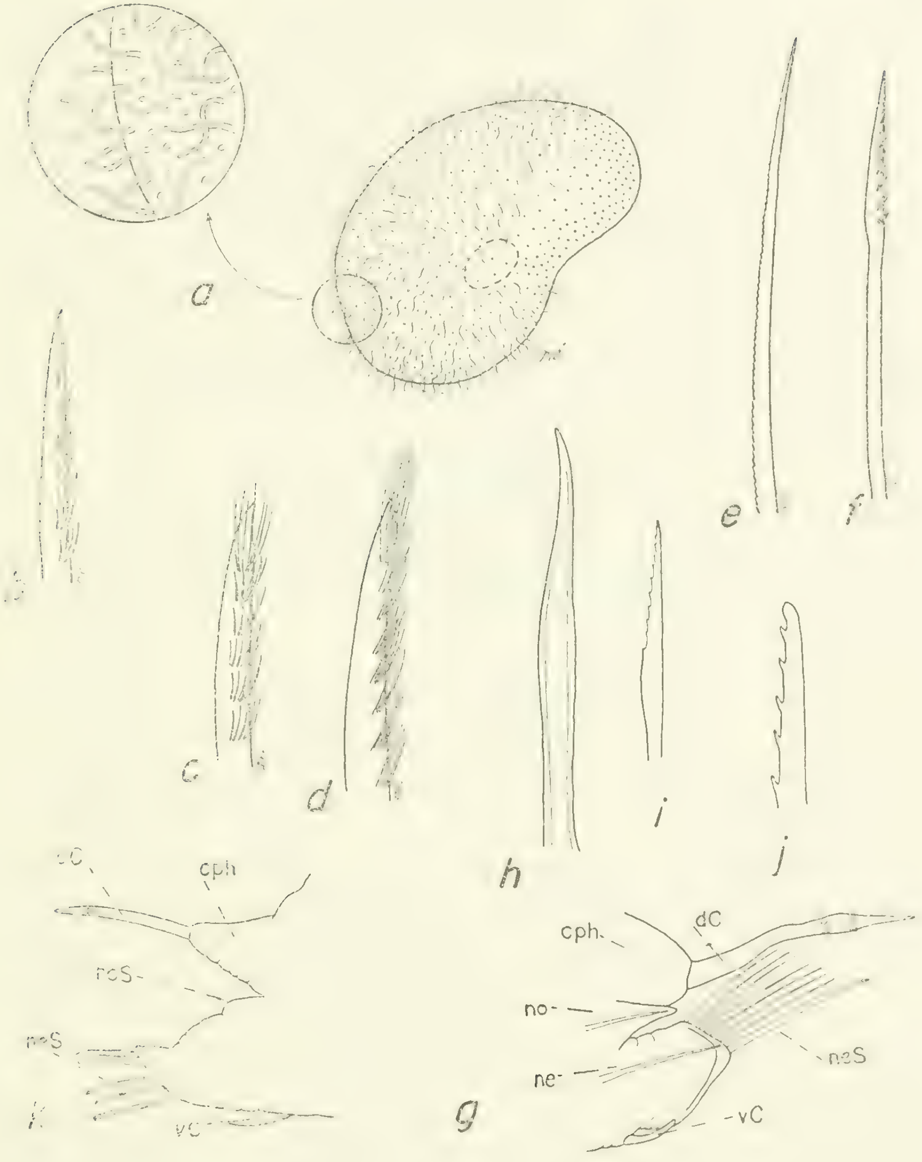

Figure 4.—Polynoidae, *a–b*, *Eucranta villosa: a*, elytron; *b*, tip of neuroseta. *c*, *Austrolaenilla lanelleae*, tip of neuroseta. *d*. *Austrolaenilla mollis*, tip of neuroseta. *e–f*, *Hartmania moorei: e*, notoseta; *f*, neuroseta. *g–j*, *Alentiana aurantiaca* (after Hartman, 1942b): *g*, twelfth parapodium, anterior view; *h*, subacicular neuroseta; *i*, supra-acicular neuroseta; *j*, tip of same, enlarged. *k*, *Lepidametria commensalis*, middle right parapodium, anterior view.

Description. Length up to 50 mm., width including setae up to 18 mm., segments 36–39. Body broad, depressed, tapering posteriorly, the last few segments very small. Elytra 17–20 pairs, large, reniform, overlapping, covering the dorsum, becoming gradually smaller posteriorly, thin, soft, translucent, smooth, lacking tubercles and fringes of papillae. Prostomium with 4 large eyes. Notopodia reduced to digitiform lobes, lacking setae (with an embedded aciculum). Neuropodia stout, provided with pale yellow neurosetae of two kinds: Upper more slender ones with barbs on one side, and few (1–2) lower stout ones, smooth and pointed. Color, in life: bright orange red.

Biology.—Deep water species living as a commensal among the tentacles of the large anemone *Bolocera tuediae* Gosse.

Material examined.—Numerous specimens from Georges Bank, off Martha's Vineyard, south of Long Island, and off Delaware Bay, in 190 to 640 fathoms.

Distribution.—Off Massachusetts to off Delaware. In 190 to 640 fathoms.

Genus *Drieschia* Michaelsen, 1892

Plotolepis Chamberlin, 1919; type (monotypy): *P. nans* Chamberlin, 1919.

Type (monotypy): *Drieschia pelagica* Michaelsen, 1892. Contains only one New England species.

Drieschia pellucida Moore, 1903b

Figure 5,*h–j*

Drieschia pellucida Moore, 1903b, p. 794, pl. 55, figs. 1–12.—Hartman, 1956, pp. 249, 265, 271.

Description.—Length up to 14 mm., width including setae up to 6 mm., segments 26. Body thin walled, colorless and transparent. Parapodia with notopodia lacking. Neuropodia elongated, prominent, with colorless neurosetae of 2 kinds: Upper elongated slender ones with capillary tips, few (3 or so) lower ones short and stout. Cirrophores of dorsal cirri elongate, some longer than the parapodia. Elytra 12 pairs (possibly 13), smooth, thin, inflated when living.

Biology.—Pelagic, found in surface tow net (single type specimen from southeast No Mans Land, Massachusetts) and in the deep waters of the Gulf Stream (off Bermuda; single type specimen of *D. atlantica* Treadwell; see Hartman, 1956).

Distribution.—Off Massachusetts, off Bermuda, part of the Gulf Stream fauna. Surface waters to 1,000 fathoms.

Genus *Enipo* Malmgren, 1865; sensu Levinsen, 1882

Nemidia Malmgren, 1865, p. 84; type (monotypy): *Nemidia torelli* Malmgren, 1865.

Type (monotypy): *Enipo kinbergi* Malmgren, 1865.

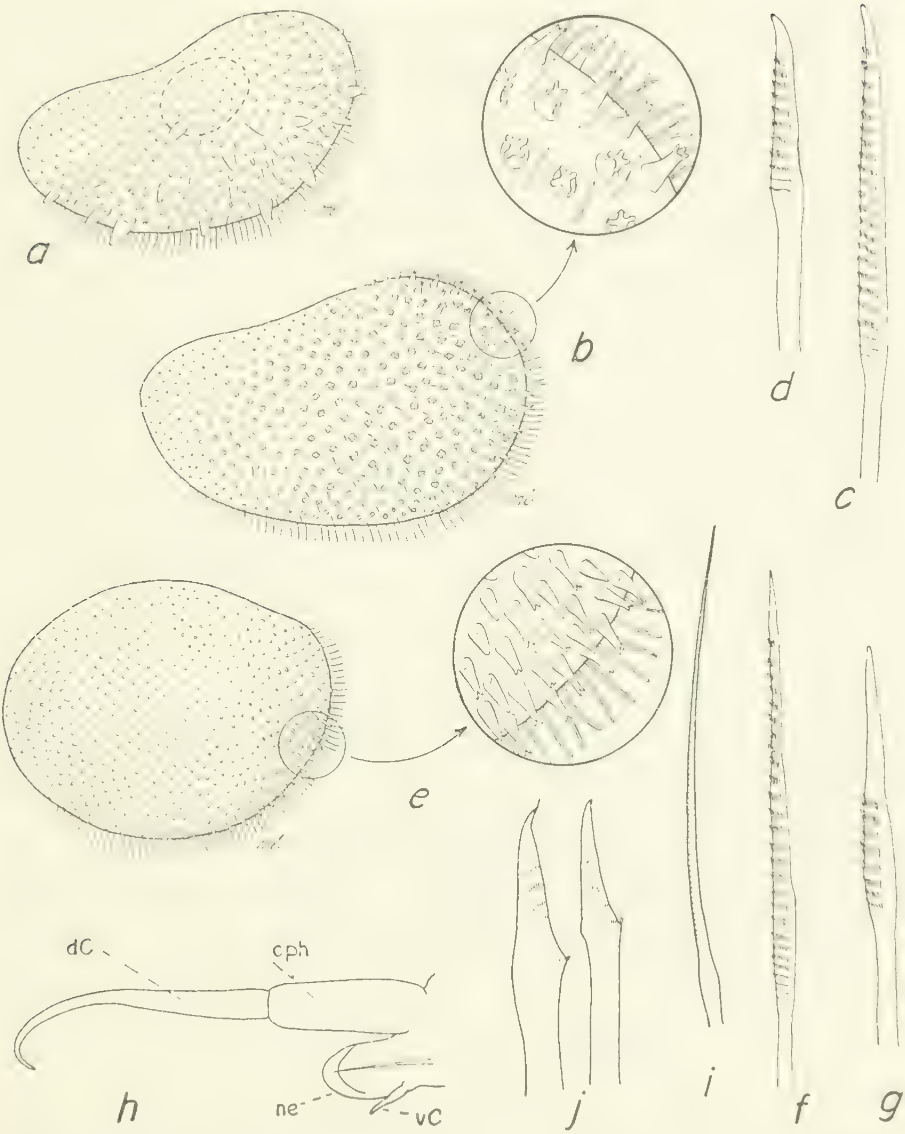

FIGURE 5.—Polynoidae, *a, Gattyana nutti,* elytron. *b–d, Gattyana cirrosa: b,* elytron; *c,* upper neuroseta; *d,* lower neuroseta. *e–g, Gattyana amondseni: e,* elytron; *f,* upper neuroseta; *g,* lower neuroseta. *h–j, Drieschia pellucida* (after Moore, 1903b): *h,* tenth parapodium, posterior view, setae omitted; *i,* upper slender neuroseta; *j,* lower stout neurosetae from tenth parapodium.

Key to the New England and Gulf of St. Lawrence Species of *Enipo*

1. Notosetae slender to moderately stout, tapering to blunt tips (not capillary); neurosetae stouter, with bare, slightly hooked tips (fig. 6,*a–c*) **E. gracilis**
   Notosetae taper to fine capillary tips 2
2. Neurosetae of two kinds: with slender sharp tips and with entire hooked tips (fig. 6,*e,f*). With two middorsal nodules per segment. Elytra very small (fig. 6*d*) . . . . **E. canadensis**
   Neurosetae taper to slender sharp tips (not hooked, fig. 6,*h, i*). Without middorsal nodules. Elytra larger . . . . **E. torelli**

Enipo gracilis Verrill, 1874a

FIGURE 6,*a–c*

Enipo gracilis Verrill, 1874a, pp. 407, 411, pl. 6, fig. 4.—Pettibone, 1953, p. 22, pl. 7; 1954, p. 225.

Polynoë gaspéensis McIntosh, 1874, p. 267, pl. 9, figs. 14, 15, pl. 10, figs. 12, 13.—Whiteaves, 1901, p. 84.

Polynoë tarasovi Annenkova, 1937, p. 154, figs. 29, 30; 1938, p. 137.—Uschakov 1955, p. 137, fig. 27.

Polynoë gracilis Hartman, 1959a, p. 101.

DESCRIPTION.—Length up to 76 mm., width including setae up to 9 mm., segments 45 to 74. Body elongate, slender, with sides nearly parallel. Prostomium without cephalic peaks or peaks weakly developed. Elytra 15 pairs, oval, smooth, translucent, small, leaving middorsum and posterior end uncovered. Notosetae slender to moderately stout, spinous, tapering to blunt tips. Neurosetae stouter, with distal spinous regions and bare, slightly hooked tips. Color: brownish middorsally; elytra pigmented smoky brown on medial halves.

BIOLOGY.—Dredged on bottoms of mud, silty clay, sand and gravel. Known to be commensal with the maldanid *Nicomache lumbricalis* (Fabricius) in Alaska (Berkeley and Berkeley, 1942) and off Halifax, Nova Scotia, and Cape Cod (Pettibone, 1954), and Gaspé Bay, Gulf of St. Lawrence.

MATERIAL EXAMINED.—Gaspé Bay and Bay of Chaleurs in Gulf of St. Lawrence, off Nova Scotia, Maine, Massachusetts (Georges Bank), Connecticut, in 2 to 108 fathoms.

DISTRIBUTION.—Alaskan Arctic to Washington, north Japan, Gulf of St. Lawrence to Connecticut. In 2 to 123.5 fathoms.

Enipo canadensis (McIntosh, 1874)

FIGURE 6,*d–f*

Nemidia(?) *canadensis* McIntosh, 1874, p. 265, pl. 10, figs. 5–9.—Whiteaves, 1901, p. 85.

Enipo canadensis Pettibone, 1953, p. 23, pl. 8, figs. 63–72.

Polynoë (*Enipo*) *pavlovskii* Uschakov, 1955, p. 170, figs.

DESCRIPTION.—Length up to 70 mm., width up to 8 mm., segments 50–90. Body long and slender, with conspicuous middorsal row of reddish-brown papillae or nodules, 2 per segment in tandem (fig. 6*d*). Elytra very small, subcircular, easily overlooked, occupying lateral regions only. Prostomium with prominent cephalic peaks, with 2 pairs of eyes, the anterior pair much larger. Notosetae short, slender, very finely serrated, tapering to fine capillary tips. Neurosetae of 2 kinds: Upper and few lower ones with long spinous regions, ending in slender sharp tips; middle ones stouter, with short spinous regions, ending in blunt, slightly hooked tips. Color, in life: colorless to yellowish, with light brown middorsal nodules; elytra light brownish on medial sides.

BIOLOGY.—Dredged on bottoms of mud, sticky black mud, muddy sand, and mud with gravel and shells.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Gaspé Bay near Cape Gaspé, 58 fathoms; 10 miles off Grande-Rivière in Bay of Chaleurs, 60 fathoms, 1959, P. Brunel).

DISTRIBUTION.—Gulf of St. Lawrence, north Japan, North Pacific (Washington). In 14 to 60 fathoms.

Enipo torelli (Malmgren, 1865)

FIGURE 6, *g–i*

Nemidia torelli Malmgren, 1865, p. 84, pl. 13, fig. 22.—Ditlevsen, 1917, p. 39.—Augener, 1928, p. 697.—Annenkova, 1937, p. 154, figs. 20–22; 1938, p. 137.—Wesenberg-Lund, 1950b, p. 29.—Uschakov, 1955, p. 142, fig. 30,*a–d*.

Nemidia (?) *lawrenci* McIntosh, 1874, p. 266, pl. 10, figs. 9–11.—Whiteaves, 1901, p. 85.

DESCRIPTION.—Length up to 50 mm., width up to 11 mm., segments 47–52. Body linear, elongated, tapering posteriorly. Prostomium with distinct cephalic peaks, with 4 very small eyes (easily overlooked). Elytra 15 pairs, suboval, smooth, fairly large, nearly covering the dorsum, leaving posterior end uncovered. Notopodia with a spreading bundle of slender, finely spinous notosetae, tapering to capillary tips. Neurosetae stouter than notosetae, with long spinous regions, tapering to short pointed tips (not hooked).

BIOLOGY.—Dredged on bottoms of soft mud, clay with gravel, stones, and rocks.

MATERIAL EXAMINED.—Gulf of St. Lawrence (south arm Gaspé Harbor, Gaspé Bay, 4 fathoms; Miscou Bank, Bay of Chaleurs, 16 fathoms; 10 miles off Grande-Rivière, Bay of Chaleurs, 60 fathoms, 1959, P. Brunel).

DISTRIBUTION.—Spitsbergen, west Greenland, Gulf of St. Lawrence, north Japan. In 4 to 888 fathoms.

Genus *Hartmania* Pettibone, 1955

Type (monotypy): *Hartmania moorei* Pettibone, 1955. Contains only one species.

Hartmania moorei Pettibone, 1955

FIGURE 4,*e–f*

Hartmania moorei Pettibone, 1955, p. 124, fig. 5,*a–e*.—Stickney, 1959, p. 15.

DESCRIPTION.—Length up to 15 mm., width including setae up to 5.2 mm., segments up to 40. Elytra 15 pairs, cover the dorsum,

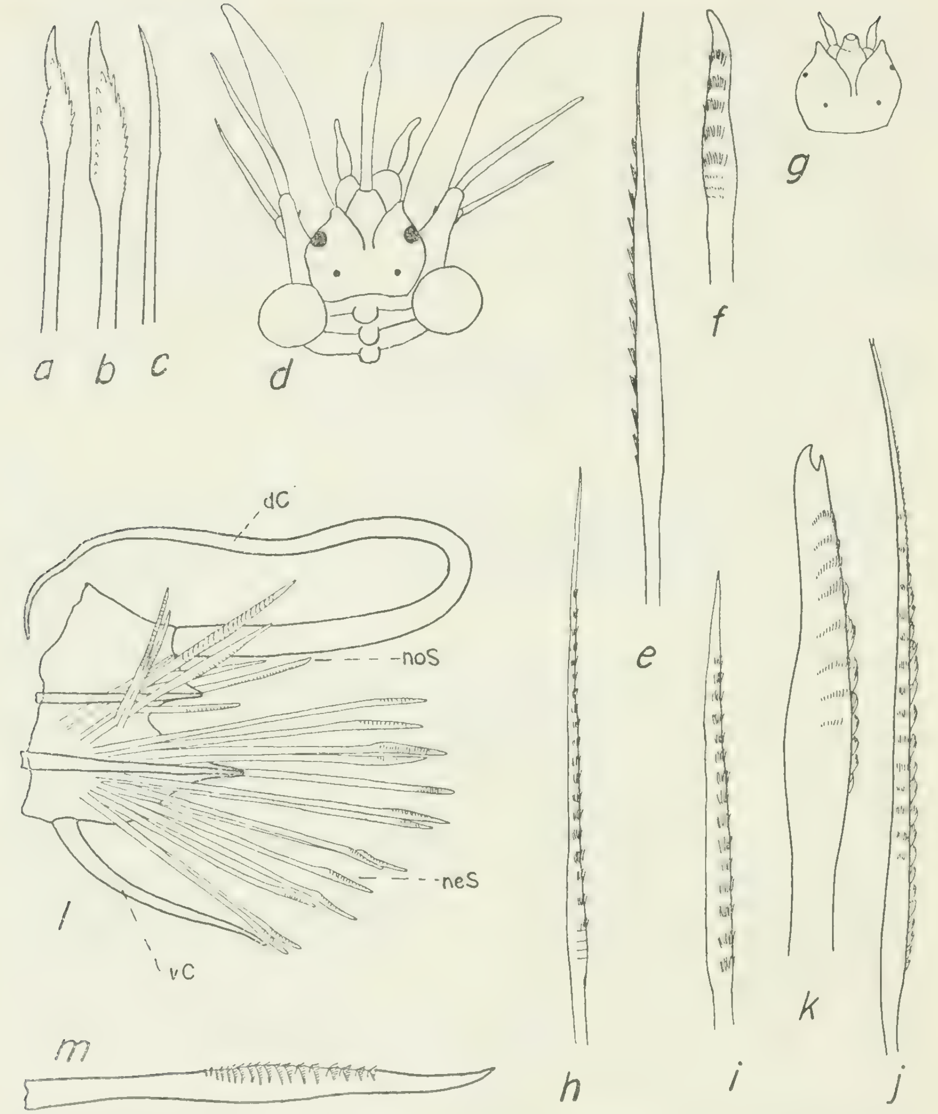

FIGURE 6.—Polynoidae, *a–c*, *Enipo gracilis* (after Verrill, 1874a): *a*, lower neuroseta; *b*, upper neuroseta; *c*, notoseta. *d–f*, *Enipo canadensis: d*, dorsal view anterior end; *e*, upper neuroseta; *f*, middle neuroseta. *g–i*, *Enipo torelli: g*, prostomium; *h*, upper neuroseta; *i*, middle neuroseta. *j–k*, *Arcteobia anticostiensis* (after McIntosh, 1874): *j*, upper neuroseta; *k*, lower neuroseta. *l–m*, *Harmothoë acanellae* (after Verrill, 1885a): *l*, parapodium; *m*, neuroseta.

smooth, without papillae or tubercles. Prostomium with distinct cephalic peaks, with 4 small eyes. Notosetae widest basally tapering gradually to short capillary tips. Neurosetae with long shafts and enlarged distal spinous regions, ending in short slender tips. Color: body colorless; elytra with crescent-shaped pale to light rusty-brown areas on medial halves.

BIOLOGY.—Found living commensally in the intertidal burrows of *Nereis virens* Sars in the sandy mud (Newcastle, New Hampshire; Boothbay Harbor region, Maine). Small and rather fast moving, easily escapes notice. Found sharing the tube of the maldanid *Praxillella gracilis* (Sars) (Sheepscot River, Maine, 5 fathoms, 1955, R. W. Hanks). Dredged on bottoms of mud, fine sand, silty clay, and muddy sand in 3 to 90 fathoms. Females found filled with eggs in November (Newcastle, New Hampshire, 1954, G. M. Moore).

MATERIAL EXAMINED.—Specimens from Maine (Sheepscot estuary, Boothbay Harbor region), New Hampshire (Little Harbor, Newcastle), Massachusetts (Georges Bank, Cape Cod), in low water to 90 fathoms.

DISTRIBUTION.—Maine (Boothbay Harbor region) to Massachusetts (Cape Cod). Low water to 90 fathoms.

Genus *Arcteobia* Annenkova, 1937

Type (original designation): *Arcteobia anticostiensis* (McIntosh, 1874). Contains only one New England species.

Arcteobia anticostiensis (McIntosh 1874).

FIGURE 6,*j*,*k*

Eupolynoë anticostiensis McIntosh, 1874, p. 265, pl. 10, figs. 1–4.—Whiteaves, 1901, p. 85.

Eucranta anticostiensis Treadwell, 1948, p. 16, fig. 5*b*.

Arcteobia anticostiensis Pettibone, 1954, p. 225; 1956a, p. 551.—Uschakov, 1955, p. 146, fig. 32.

DESCRIPTION.—Length up to 26 mm., width including setae up to 8 mm., segments up to 36. Prostomium with distinct cephalic peaks; anterior pair of eyes anteroventral. Elytra 15 pairs, cover the dorsum, without fringes of papillae, smooth except for scattered microtubercles on anterior curved part. Upper notosetae shorter, stouter, with blunt tips; rest of notosetae with capillary tips. Few upper neurosetae longer, ending in sharp slender tips; rest of neurosetae with bifid tips. Color: irregularly banded middorsally, greenish to greenish black; elytra with reddish brown pigmented areas.

BIOLOGY.—Dredged on bottoms of sandy mud and mud with various combinations of sand, pebbles, gravel, stones, rocks, and shells. Probably commensal in habit. Found living commensally in the sinuous tubes of the terebellid *Pista flexuosa* (Grube), one worm per tube (off Labrador, Pettibone, 1954). Found in the tubes of a maldanid (Gaspé Bay, 10–23 fathoms, June 1957, August 1958; Georges Bank, 42°51′ N., 70°36′ W., 51 fathoms, July 1960).

MATERIAL EXAMINED.—Off Labrador, Gaspé Bay and Bay of Chaleurs in Gulf of St. Lawrence, Nova Scotia, Maine, Massachusetts, in 3 to 95 fathoms.

DISTRIBUTION.—Arctic Alaska, Bering Sea, north Japan Sea, Labrador to Massachusetts. In low water to 123.5 fathoms.

Genus *Gattyana* McIntosh, 1897

Nychia Malmgren, 1865, preoccupied by Stål (1859, Hemiptera); type (monotypy): *Nychia cirrosa* (Pallas, 1766).

All 3 species with 15 pairs of elytra, overlapping, covering the dorsum; elytral surface covered with numerous microtubercles and lateral fringes of papillae. Prostomium with distinct cephalic peaks, anterior pair of eyes anteroventral, not visible dorsally. Upper notosetae stouter, curved, with blunt tips; rest end in fine to capillary tips. Neurosetae with distal spinous regions and entire, slightly hooked tips. Color: variable, tan, tan mottled with brown, with or without a darker spot near elytrophore, with or without a darker streak middorsally.

Key to the New England Species of *Gattyana*

1. With some larger conical macrotubercles in addition to the microtubercles (fig. 5*a*) . . . . **G. nutti**
   Without conical macrotubercles 2
2. Elytral microtubercles 1 to 4 pronged (fig. 5*b*). Lower neurosetae with the bare distal tips not longer than the spinous regions (fig. 5*d*). **G. cirrosa**
   Elytral microtubercles conical and bifid (fig. 5*e*). Lower neurosetae with the bare tips as long as or longer than the spinous regions (fig. 5*g*). **G. amondseni**

Gattyana cirrosa (Pallas, 1766)

FIGURE 5,*b–d*

Nychia cirrosa Verrill, 1881, pp. 306, 311.—Webster and Benedict, 1884, p. 700; 1887, p. 708.—Whiteaves, 1901, p. 86.

Gattyana cirrosa Fauvel, 1923, p. 49, fig. 17, *a–f*.—Procter, 1933, p. 135.—Treadwell, 1948, p. 19, fig. 7*b*.—Miner, 1950, p. 307, pl. 100.—Pettibone, 1953, p. 41, pl. 20; 1954, p. 226, fig. 26*b*; 1956a, p. 551.—Davenport, 1953, p. 169. Newell, 1954, p. 333.—Uschakov, 1955, p. 143, fig. 31.—Southward, 1956, p. 257.—Clark, 1960, p. 11.—Eliason, 1962, p. 217.

DESCRIPTION.—Length up to 47 mm., width including setae up to 12 mm., segments 35–38. Elytral microtubercles simple, bifid or quatrifid, the latter especially characteristic (not so prominent when commensal). Elytra with long papillae scattered on the surface as well as on the external borders, usually covered with debris, giving a straggly appearance.

BIOLOGY.—Dredged on various combinations of mud, sand, pebbles, gravel, with shells, sponges, algae, mud tubes. Found at low water on rocky ledges with muck, on rocks in encrusting calcareous algae. Single specimen found among the fouling organisms on buoys, etc., in the oceanographic fouling studies in the New England region. Found among oysters (South Carolina). Found living commensally in the mud tubes of the terebellid *Amphitrite johnstoni* Malmgren (includes *A. brunnea* and *A. figulus*) in both the western Atlantic (Mount Desert region, Gulf of Maine, Procter, 1933; Eastport, Maine, Webster and Benedict, 1887; St. Andrews, New Brunswick, under rocks, Pettibone, 1955; Machias Bay and Boothbay Harbor region, Maine, sandy mud and gravelly sand flats, Pettibone, 1955; Fort Stark, Newcastle, New Hampshire, G. M. Moore, collected in 1956) and eastern Atlantic (British shores, McIntosh, 1900). Found sharing the tubes of *Chaetopterus variopedatus* (Renier) (Ireland, Southern, 1914; Isle of Man, Southward, 1956). Found also in lugworm burrows (British shores, Newell, 1954).

MATERIAL EXAMINED.—Off Labrador, Gulf of St. Lawrence (St. Lawrence estuary, Gaspé Bay, Bay of Chaleurs), Nova Scotia, New Brunswick, Maine, New Hampshire, Massachusetts (Cape Cod and Vineyard Sound), South Carolina, in low water to 129 fathoms.

DISTRIBUTION.—Arctic, Iceland, Norway to France, Hudson Bay to South Carolina, Bering Sea to Washington, north Japan Sea. In low water to 630 fathoms.

Gattyana amondseni (Malmgren, 1867)

FIGURE 5,*e–g*

Nychia amondseni Verrill, 1881, pp. 303, 306.—Webster and Benedict, 1884, p. 700.—Whiteaves, 1901, p. 86.

Gattyana amondseni Treadwell, 1948, p. 20, fig. 7*c*.—Grainger, 1954, p. 509.—Uschakov, 1955, p. 143, fig. 31.—Pettibone, 1956a, p. 552.—Eliason, 1962, p. 216.

DESCRIPTION.—Length up to 30 mm., width including setae up to 12 mm., segments 35, 36. Elytral microtubercles conical and bifid; elytral fringe confined mostly to external borders.

BIOLOGY.—Dredged on bottoms of mud, silty clay, and mud with rocks, sand, pebbles, gravel, red algae.

MATERIAL EXAMINED.—Off Labrador, Gulf of St. Lawrence (Gaspé Bay, South Anticosti Island, Bay of Chaleurs), Nova Scotia, Maine, Massachusetts, Rhode Island, in low water to 120 fathoms.

DISTRIBUTION.—Arctic, Alaska, Norway, Hudson Bay to Rhode Island. In low water to 378 fathoms.

Gattyana nutti Pettibone, 1955

FIGURE 5*a*

Gattyana nutti Pettibone, 1955, p. 119, fig. 2,*a–f*.

DESCRIPTION.—Length up to 17 mm., width including setae up to 5 mm., segments 35, 36. Elytral macrotubercles conical; microtubercles entire or bifid, few quatrifid. Elytra with long papillae scattered on the surface as well as on external borders.

Biology.—Dredged on bottoms of mud, mud with rocks, coral, fine sand and pebbles.

Material examined.—Off Labrador, Gulf of St. Lawrence (Bay of Chaleurs), Nova Scotia, Maine, Massachusetts (Cape Cod), in 25 to 67 fathoms.

Distribution.—Southern Labrador coast (Strait of Belle Isle) to Massachusetts (Cape Cod). In 25 to 67 fathoms.

Genus *Antinoëlla* Augener, 1928

Type (designated by Uschakov, 1955): *Antinoëlla sarsi* (Malmgren, 1865).

Both species have the anterior pair of eyes at the level of the greatest prostomial width, visible dorsally. Elytra 15 pairs, easily deciduous. Notopodia and neuropodia extending into conspicuous digitiform acicular lobes. Setae golden yellow. Notosetae much thicker than neurosetae, finely spinous, with short pointed to blunt smooth tips.

Key to the New England Species of *Antinoëlla*

1. Neurosetae of two kinds: With capillary tips and with slender, relatively obtuse and slightly curved tips (fig. 7,*h–j*). Prostomium with anterior pair of eyes larger than posterior pair (fig. 7*e*) . . . . **A. sarsi**
   All neurosetae with long, flexible capillary tips (fig. 7,*l–m*). Prostomium with four subequal eyes (fig. 7*k*) . . . . **A. angusta**

Antinoëlla sarsi (Malmgren, 1865)

Figure 7,*e–j*

Antinoë sarsi Verrill, 1881, pp. 297, 303, 306, 307, 311.—Whiteaves, 1901, p. 85.—Treadwell, 1948, p. 17, fig. 6*a*.—Miner, 1950, p. 304, pl. 99.—Pettibone, 1954, p. 215; 1956a, p. 547.

Antinoëlla sarsi Uschakov, 1955, p. 160, fig. 43; 1957, p. 1665.—Hartman, 1959a, p. 62.

Description.—Length up to 68 mm., width including setae up to 27 mm., segments 37, 38. Elytra large, thin, soft, smooth, with scattered microtubercles and short delicate clavate papillae.

Biology.—Dredged on bottoms of mud with gravel, stones. Swims quickly by making use of its long parapodia; may be pelagic. Found in stomach of haddock (43°39′ N., 60°30′ W., June 20, 1953, R. Wigley).

Material examined.—Off Labrador, Gulf of St. Lawrence (Bay of Chaleurs), Massachusetts (Georges Bank), in 6 to 70 fathoms.

Distribution.—Widely distributed in the Arctic. Also Iceland, Norway to Great Britain, the Baltic, Labrador to Massachusetts, Bering Sea, north Japan Sea. In 3 to 1,215 fathoms.

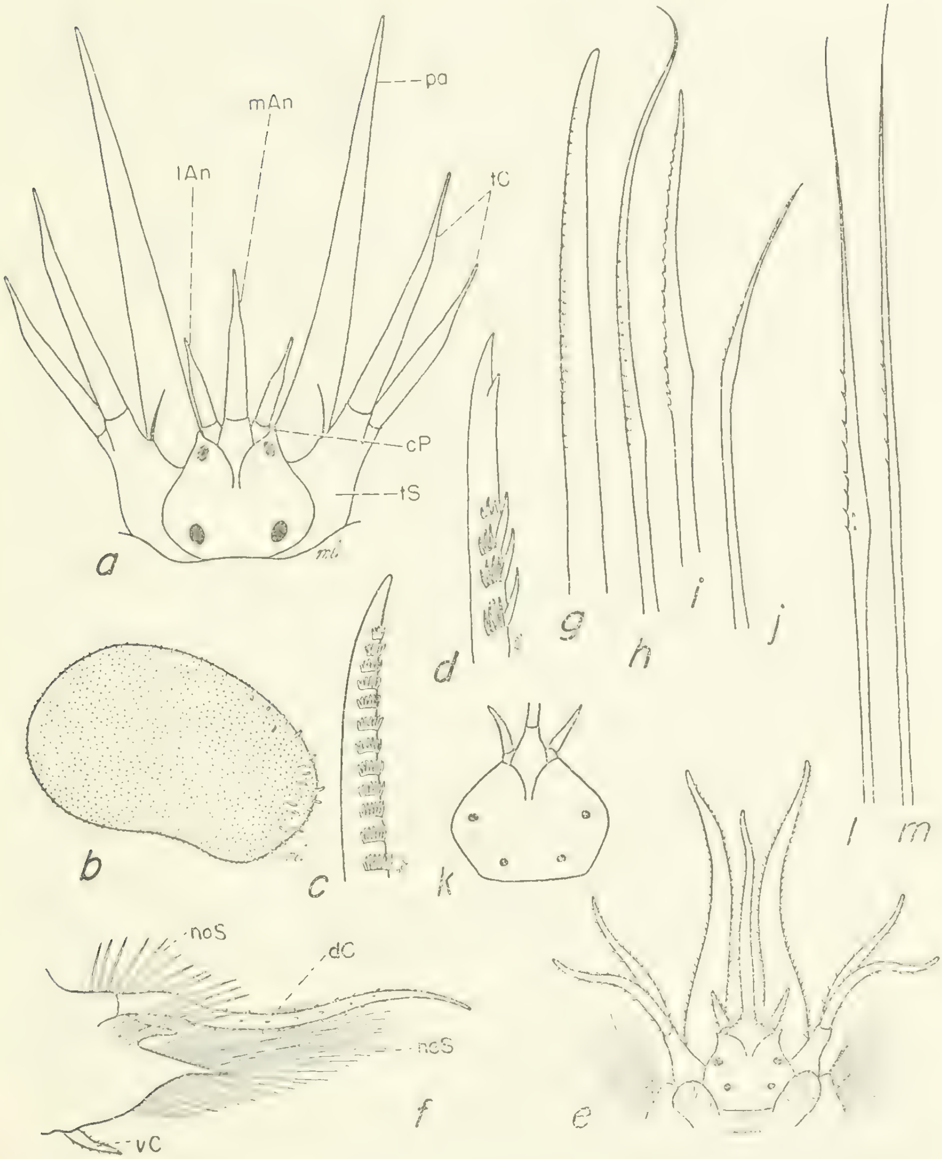

FIGURE 7.—Polynoidae, *a–d*, *Harmothoë imbricata*: *a*, dorsal view prostomium and tentacular segment (ventral anterior pair of eyes visible through translucent prostomium); *b*, elytron; *c*, tip of notoseta; *d*, tip of neuroseta. *e–j*, *Antinoëlla sarsi* (after Malmgren, 1865): *e*, dorsal view anterior end; *f*, parapodium from setiger 13, posterior view; *g*, notoseta; *h*, upper neuroseta; *i*, middle neuroseta; *j*, lower neuroseta. *k–m*, *Antinoëlla angusta*: *k*, prostomium; *l*, upper neuroseta; *m*, lower neuroseta.

***Antinoëlla angusta* (Verrill, 1874)**

FIGURE 7,*k–m*

Antinoë angusta Verrill, *in* Smith, Harger, and Verrill, 1874, pp. 22, 36.—Hartman, 1942b, p. 23, figs. 13–18.

Antinoëlla angusta Hartman, 1959a, p. 62.

DESCRIPTION.—Length up to 25 mm., width including setae up to 7 mm., segments 36. Elytra relatively large, covering dorsum, with scattered microtubercles over complete surface and with additional elongate filiform papillae on exposed part, with brownish pigment on medial halves.

BIOLOGY.—Dredged on bottoms of mud, clay and silty clay.

MATERIAL EXAMINED.—Off Massachusetts (Georges Bank), 90 to 130 fathoms.

DISTRIBUTION.—Few scattered records from Gulf of Maine to Cape Cod, Massachusetts. In 72 to 150 fathoms.

Genus *Austrolaenilla* Bergström, 1916; emend. Pettibone, 1955

Type (monotypy): *Austrolaenilla antarctica* Bergström, 1916.

Both species have the prostomium with four large eyes, visible dorsally, with distinct cephalic peaks. Notopodia and neuropodia with prominent digitiform acicular lobes. Setae golden yellow. Notosetae shorter and stouter than neurosetae, with numerous spinous rows. Neurosetae slender, spinous, with secondary tooth and hairs on distal tip.

Key to the New England Species of *Austrolaenilla*

1. Elytra 15 pairs. Neurosetae with hairs extending up to or slightly beyond distal tip (fig. 4*c*). Notosetae arched, with spinous rows extending nearly to distal tip . . . . **A. lanelleae**

   Elytra 16 pairs. Neurosetae with hairs longer (fig. 4*d*). Notosetae nearly straight, with pointed bare tips . . . . **A. mollis**

Austrolaenilla mollis (Sars, 1871)

FIGURE 4*d*

Laenilla mollis Sars, 1873, p. 207, pl. 14.—Verrill, *in* Smith, Harger, and Verrill, 1874, pp. 16, 35.
Antinoë mollis McIntosh, 1900, p. 369, figs.
Harmothoë mollis Wesenberg-Lund, 1950b, p. 24.
Antinoëlla mollis Hartman, 1959a, p. 83.

DESCRIPTION.—Length up to 50 mm., width including setae up to 23 mm., segments up to 43. Body large, flattened dorsoventrally, banded with brown. Elytra 16 pairs, large, thin, soft, transparent, covering the dorsum except for last few posterior segments, smooth except for few scattered pointed papillae on surface (may be lacking) and few microtubercles on anterior curved part.

BIOLOGY.—Dredged on bottoms of mud, sandy mud, and gravel.

MATERIAL EXAMINED.—Off Newfoundland, Gulf of St. Lawrence (South Anticosti Island), Massachusetts (Georges Bank, Martha's Vineyard, Provincetown), in 20 to 471 fathoms.

DISTRIBUTION.—West Greenland, off Norway, Faroes, Iceland, Danish waters, off Newfoundland to Massachusetts. In 20 to 471 fathoms.

Austrolaenilla lanelleae (Pettibone, 1955)

FIGURE 4c

Austrolaenilla lanelleae Pettibone, 1955, p. 118, fig. 1,*a–f*.

DESCRIPTION.—Length up to 23 mm., width including setae up to 7.5 mm., segments 40, 41. Elytra missing.

BIOLOGY.—Dredged on bottoms of sandy mud, associated with numerous specimens of the commensal polynoid, *Harmothoë acanellae*.

MATERIAL EXAMINED.—Off Martha's Vineyard, Massachusetts, 458 fathoms; 39°48′ N., 71°06′ W., 700 fathoms, August 27, 1959, R. Wigley.

DISTRIBUTION.—Off Massachusetts. In 458 to 700 fathoms.

Genus *Eucranta* Malmgren, 1865

Eupolynoë McIntosh, 1874; type (herein designated): *Eupolynoë occidentalis* McIntosh, 1874;=*Eucranta villosa* Malmgren, 1865.

Type (monotypy): *Eucranta villosa* Malmgren, 1865. Contains only one New England species.

Eucranta villosa Malmgren, 1865.

FIGURE 4,*a*,*b*

Eucranta villosa Malmgren, 1865, p. 80, pl. 10, fig. 9.—Verrill, *in* Smith, Harger, and Verrill, 1874, pp. 22, 37.

Eupolynoë occidentalis McIntosh, 1874, p. 264, pl. 9, figs. 8–13.—Whiteaves, 1901, p. 85.

Eucranta occidentalis Treadwell, 1948, p. 16, fig. 5*c*.

Harmothoë villosa Wesenberg-Lund, 1950b, p. 25; 1953, p. 22.

Harmothoë (*Eucrante*) *villosa* Eliason, 1962, p. 221.

DESCRIPTION.—Length up to 53 mm., width including setae up to 14 mm., segments 36–40. Elytra 15 pairs, covering the dorsum, with numerous papillae scattered on surface as well as on posterior and lateral borders, with scattered microtubercles on anterior curved part. Prostomium with cephalic peaks weakly developed, anterior pair of eyes larger than posterior pair, anterolateral in position. Setae golden yellow. Notosetae form a very bushy bundle; they are short, stout, strongly curved, with spinous rows extending almost to tip. Neurosetae longer, with spinous rows. Upper neurosetae with tips slender, nearly straight, split or forceps-like (fig. 4*b*); middle and lower ones shorter, with long bare entire tips.

BIOLOGY.—Dredged on bottoms of mud, sand, and gravel.

MATERIAL EXAMINED.—Gulf of St. Lawrence, Massachusetts (Georges Bank, Cape Cod, Martha's Vineyard), in 105–410 fathoms.

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Norway to Denmark, Gulf of St. Lawrence to Massachusetts, Bering Sea. In 9 to 609 fathoms.

Genus *Harmothoë* Kinberg, 1855

Evarne Malmgren, 1865; preoccupied by Adams (1853, Moll.); type (monotypy): *Evarne impar* Malmgren, 1865 (not *Polynoë impar* Johnston, 1839); = *Harmothoë fragilis* Moore, 1910 (see below, p. 39).

Evarnella Chamberlin, 1919, new name for *Evarne*, preoccupied.

Type (designated by Bergström, 1916): *Harmothoë spinosa* Kinberg, 1855.

Subgenus *Hermadion* Kinberg, 1855

Type (designated by Bergström, 1916): *Hermadion magalhaensis* Kinberg, 1855.

Subgenus *Lagisca* Malmgren, 1865

Type (monotypy): *Lagisca rarispina* (Sars, 1860); =*Harmothoë extenuata* Grube, 1840.

Subgenus *Eunoë* Malmgren, 1865

Type (designated by Uschakov, 1955): *Eunoë nodosa* (Sars, 1860).

All the species represented have the body relatively short (35–80 segments), widest in anterior third, attenuated posteriorly, fragmenting and losing elytra readily. Elytra 15 pairs, covering the dorsum except for the more posterior segments in the longer species; elytra provided with chitinous conical microtubercles, with or without additional macrotubercles. Notosetae as stout as or stouter than the neurosetae, with well-marked spinous rows and smooth blunt to pointed tips (fig. 7*c*). Neurosetae with elongated spinous regions, with tips slightly hooked, with or without a secondary subterminal tooth (fig. 7*d*).

Key to the New England Species of *Harmothoë*

1. Segments more than 50 (50–80). Notosetae few in number (4–10).
H. (Hermadion) acanellae (p.35)
Segments less than 50 (35–49). Notosetae more numerous 2

2. Anterior pair of eyes anteroventral, not visible dorsally (fig. 7*a*).
H. imbricata (p.36)
Anterior pair of eyes anterolateral, visible dorsally (fig. 8*a*) 3

3. Elytra with microtubercles only or with additional globular to rodlike soft macrotubercles (figs. 8,*b–c,e,g*; 9,*e,g*). Neurosetae with tips entire or with secondary tooth (fig. 7*d*) 4
Elytra with microtubercles and additional nodular to spiny macrotubercles (fig. 9,*b,d*). Neurosetae with entire bare tips (fig. 9*c*) 8

4. Elytra with few scattered microtubercles mostly on anterior half of elytra (fig. 8*g*). All neurosetae with tips bifid (with secondary tooth). **H. dearborni** (p.38)
   Elytra with microtubercles more numerous 5
5. With a distinct nuchal fold posterior to prostomium (fig. 8*d*). Neurosetae with large secondary tooth at base of long bare tip (fig. 8*f*). **H. macginitiei** (p.39)
   Without distinct nuchal fold. Neurosetae with tips entire (fig 9*f*) or with secondary tooth close to tip (fig. 7*d*) 6
6. Elytra with microtubercles only, short conical to elongate conical or spinelike (fig. 9*e*). Neurosetae with short bare entire tips (fig. 9*f*). **H. (Eunoë) spinulosa** (p.42)
   Elytra usually with additional macrotubercles. Microtubercles not spinelike. Neurosetae with longer bare tips, with or without secondary tooth or remnant of one 7
7. Elytra with soft macrotubercles near posterior border, wider at base, not sharply set off from elytral surface (fig. 9*g*). . . . . **H. fragilis** (p.39)
   Elytra with soft macrotubercles (may be absent), globular, sausage shaped or elongate, rodlike, not wider at base and sharply set off from elytral surface (fig. 8,*b*, *c*) . . . . **H. (Lagisca) extenuata** (p.41)
8. Elytra with macrotubercles confined to single row near external border, nodular, with roughened tips (fig. 9*b*). Extra rounded lobes on inner sides of elytrophores and dorsal tubercles (lobes corresponding to elytrophores on non-elytra-bearing segments; fig. 9*a*) . . . . . **H. (Eunoë) nodosa** (p 44)
   Elytra with macrotubercles branched, scattered on elytral surface (fig. 9*d*). Without extra rounded lobes on inner sides of elytrophores and dorsal tubercles . . . . **H. (Eunoë) oerstedi** (p.44)

Harmothoë (Hermadion) acanellae (Verrill, 1881)

FIGURE 6,*l*,*m*

Polynoë (Eunoa) acanellae Verrill, 1881, pl. 6, fig. 5; 1885a, p. 525, pl. 39, fig. 172; 1885b, p. 424.—Hartman, 1942b, p. 27, figs. 27–31; 1944a, p. 337, pl. 14, fig. 9; 1959a, p. 98.—Miner, 1950, p. 302, pl. 99.

Harmothoë acanellae Ditlevsen, 1917, p. 27, pl. 1, figs. 6, 8–9, 13, pl. 2, fig. 4.—Wesenberg-Lund, 1950a, p. 7; 1951, p. 15.

DESCRIPTION.—Length up to 90 mm., width including setae up to 15 mm., segments 50–80. Elytra 15 pairs, easily deciduous, large, cover dorsum except for middorsum and posterior end, elongate oval, thin, translucent, appearing smooth but provided with numerous close-set conical microtubercles, without fringe of papillae, pale yellowish white and more or less speckled with orange brown. Prostomium with 4 large eyes, subequal, visible dorsally, with distinct cephalic peaks. Notopodia and neuropodia with prolonged slender acicular lobes. Notosetae few in number (4–10), stout, with rather long bare acute tips. Neurosetae with long spinous regions and long bare hooked tips. Proboscis large, dark purple.

BIOLOGY.—Dredged mostly in deeper waters, associated with corals. They have been found living commensally among the branches of the horny coral *Acanella arbuscula* (J. Y. Johnson), where they are found among the close branches near the base of the coral, moving about among the branches and where they may be very abundant (Verrill, Ditlevsen); also with the horny coral *Acanthogorgia armata* Verrill (*Albatross* Station 2528). They have also been found with the sea pen *Pennatula grandis* Ehrenberg (collections in USNM) and the soft coral *Anthomastus grandiflorus* Verrill (Ditlevsen).

MATERIAL EXAMINED.—Numerous specimens from off Nova Scotia, Grand Banks, Massachusetts, Rhode Island, Chesapeake Bay, North Carolina, in 23 to 1,230 fathoms.

DISTRIBUTION.—West Greenland, Iceland, Faroes, Denmark, off Nova Scotia to North Carolina. In 23 to 1,230 fathoms.

Harmothoë imbricata (Linné, 1767)

FIGURE 7,*a–d*

Harmothoë imbricata Verrill, 1881 (part—mixed with *H. extenuata*), pp. 290, 293, 296, 300, 303, 307, 311, 316, pl. 6, fig. 1,*a–d*.—Webster and Benedict, 1884, p. 701; 1887, p. 709.—Whiteaves, 1901, p. 84.—Sumner, Osburn, and Cole, 1913, p. 617 (part ?).—Kindle, 1917, p. 150.—Fauvel, 1923, p. 55, fig. 18,*f–l*; 1953, p. 42, fig. 19,*f–i*.—Préfontaine, 1932, p. 207.—Procter, 1933, p. 135 (part ?).—Treadwell, 1948, p. 17, fig. 5*d*.—Miner, 1950, p. 306, pl. 100.—Pratt, 1951, p. 328.—Pettibone, 1953, p. 32, pls. 13–16; 1954, p. 220, fig. 26,*a,e*; 1956a, p. 549.—Newell, 1954, p. 333.—Uschakov, 1955, p. 154, fig. 38.—Rasmussen, 1956, p. 8, figs. 4–6.—Costello, et al., 1957, p. 76.—Stickney, 1959, p. 16.—Uschakov and Wu, 1959, p. 36.—Clark, 1960, p. 11.

Harmothoë hartmanae Pettibone, 1948, p. 412, fig. 1,*a–f*.

DESCRIPTION.—Length up to 65 mm., width including setae up to 19 mm., segments 36–39. Prostomium with distinct cephalic peaks, anterior pair of eyes anteroventral near cephalic peaks—not visible dorsally (may be seen through translucent prostomium, especially when living). Elytra with scattered conical microtubercles, with or without few to numerous, brownish to reddish, globular to elongate cylindrical macrotubercles in one to several irregular rows near posterior border, with or without short fringe of papillae. Neurosetae with long spinous regions and bare hooked tips, usually with a subterminal tooth (fig. 7*d*).

Color: Body irregularly pigmented dorsally, greyish to blackish, dark green or brown. Elytra show remarkable color variations both as to color and color pattern. Color includes various shades of grey, black, green, red, brown, and tan, with or without additional black flecks. Color pattern includes speckled and mottled coloration with a light spot near the elytrophore, with or without a darker spot (giving the appearance of an "eye" on each elytron). Uniformly colored, with or without a darker spot near the elytrophore. Inner fourth to half of elytra uniformly colored, outer part without color or few scattered spots, thus forming a wide middorsal longitudinally striped pigmented band. A dark border on median, posterior, and lateral borders and completely encircling the first pair of elytra (the color variety of *H. hartmanae*).

Biology.—A ubiquitous species, one of the most common and abundant polynoids in all northern waters, found both intertidally and dredged in the Arctic, North Atlantic, and North Pacific. Intertidally, found clinging to rough surfaces of stones; in cracks and crevices; in rocky tide pools with algae and cavities of sponges; in roots and eelgrass (*Zostera*), and sea basketgrass (*Phyllospadix*); in holdfasts and on fronds of kelp (as *Laminaria*), under encrusting calcareous algae, on pilings, wharves, submerged wood work, among bryozoans, hydroids, tunicates, barnacles, and mussels. One of the most abundant polychaetes of the oceanographic fouling studies in the New England region. Dredged on all types of bottoms—on bottoms of mud, sand, and rock and various combinations of shell, rock, gravel, mud, and sand; among brown, red, and green algae (often tending to match in coloration the algae on which it is found); among mussels, sponges, barnacles, bryozoans, hydroids, tunicates, and sand dollars; and in and among old worm tubes.

Found living commensally with other polychaetes, as the terebellids *Thelepus crispus* Johnson (Washington, Pettibone, 1953) and *Amphitrite robusta* (Johnson) (British Columbia, Berkeley and Berkeley, 1948) and the onuphid *Diopatra ornata* Moore (Washington, Pettibone, 1953). Found with hermit crabs occupying snail shells, the polynoid often found in the apex of the shell (Carr Inlet, Puget Sound, Washington, 10 fathoms, associated with *Pagurus ochotensis* Brandt inside a shell of *Polinices lewisii* (Gould), J. E. Lynch; Bering Sea, 33 fathoms, *Albatross* Station 3303, found in apex of shell). Also found in the ambulacral groove of the asteroid *Asterias amurensis* Lutken (Japan, Okuda, 1936).

Attached to various parts of the dorsal surface under the elytra of adult females, the eggs and various stages up to advanced trochophores may be found clumped together like a loose bunch of grapes by a transparent mucous secretion. Eggs or larvae under the elytra found in Japan during March and April (Izuka, 1912), in Washington in June, July, August (Pettibone, 1953), in central California in June (Hartman, 1944b), in Norway in February and March (M. Sars, 1845, as *Polynoë cirrata*), in Denmark in January (Rasmussen, 1956), in Iceland in April and May (Saemundsson, 1918), in Britain in February to May (McIntosh, 1900) and in December (Newell, 1954), in Ireland in March (Southern, 1914), in New Hampshire in February and April (Fort Stark, 1954, February 15 and April 1 and 7, Pettibone). In the Woods Hole region, Massachusetts, females of presumably this species ("*Harmothoë* sp."– could also be *H. extenuata*) found with pink eggs inside the body from mid-April through

May; induced to shed eggs in the Laboratory (Mead, 1897, 1898; Bumpus, 1898a-c); none observed with eggs under the scales. Rasmussen (1956) found larvae in plankton in Denmark waters from November to April, with a maximum in January and February; he gives a detailed account of early stages.

Harmothoë imbricata seems to have great powers of dispersal and adaptation. Among the contributing factors, the following may be mentioned: The habit of the female protecting the eggs by carrying them under the elytra, the relatively long planktotrophic larval life (Thorson, 1946; Rasmussen, 1956), and the adaptability to living both free-living and commensally. According to Rasmussen, young bottom stages of 9 or more setigers and 4 pairs of elytra may be found in the plankton also. Larger individuals (up to 7–9 mm. in length) may live as true bottom animals and for a time—before fully grown—semipelagically, swimming briskly in the water at some distance from the bottom. An active swimmer, swimming by making undulatory movements of the body. Very euryhaline, withstanding rather fresh water (enters the Baltic and reaches into the interior of the Gulf of Finland (Ditlevsen, 1937). Found in salt ponds of low salinity in Rhode Island (Charlestown Pond, November 12, 1954, H. P. Jeffries). Withstands great range in temperature. Great powers of accomodation bathometrically—while most common in coastal areas, taken also from great depths (up to 2,030 fathoms in southwestern Greenland). Great adaptability in habitat, living on a great variety of bottoms.

MATERIAL EXAMINED.—Numerous specimens from Labrador, Gulf of St. Lawrence to Long Island Sound, intertidal to 150 fathoms.

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland and Norway to Mediterranean and Adriatic, Labrador to New Jersey, Bering Sea to southern California, Japan, Yellow Sea, Indian Ocean. In low water to 2,030 fathoms.

Harmothoë dearborni Pettibone, 1955

FIGURE 8*g*

Harmothoë dearborni Pettibone, 1955, p. 121, fig. 3,*a–i*.

DESCRIPTION.—Length up to 13 mm., width including setae up to 4 mm., segments 35. Dorsally body rusty red with 2 narrow white bands per segment. Elytra thin, transparent, rusty red with white flecks, without fringe of papillae; elytral surface smooth except for delicate scattered short papillae and scattered low microtubercles which are mostly confined to the anterior half. Prostomium with distinct cephalic peaks, anterior third of prostomium dark brown. Dorsal cirri pigmented on basal third and with a darker subterminal ring.

Biology.—Found attached to floating gulfweed, as *Sargassum*, which it matches in coloration. Specimen massed with eggs (September 1953, Vineyard Sound).

Material examined.—Specimens attached to gulfweed, Vineyard Sound, Massachusetts.

Distribution.—Massachusetts (Vineyard Sound). On floating gulfweed.

Harmothoë macginitiei Pettibone, 1955

Figure 8,*d–f*

Harmothoë macginitiei Pettibone, 1955, p. 122, fig. 4,*a–i*.

Description.—Length up to 20 mm., width including setae up to 9 mm., segments 36. Body wide, greatly flattened. Elytra large, imbricated, completely covering the dorsum, with numerous microtubercles which gradually get larger more posteriorly on each elytron; microtubercles conical, pointed, some bifid, some quadrifid or irregular, with thick fringe of papillae on lateral and posterior elytral borders as well as on surface. Prostomium with cephalic peaks blunt or poorly developed, with 4 small eyes. Setae golden yellow. Notosetae form a very thick bushy bundle, extending almost as far distally as the neurosetae; upper ones shorter, more arched; rest longer, with rather long bare pointed tips and long spinous rows. Neurosetae with long bare hooked tips and with straight secondary tooth some distance from the tip.

Biology.—Found intertidally in muddy sand, where it was dug under water.

Material examined.—Known from a single specimen collected at low tide, Hadley Harbor, Naushon Island, Massachusetts.

Distribution.—Massachusetts (Elizabeth Islands). Low water.

Harmothoë fragilis Moore, 1910

Figure 9*g*

Evarne impar Malmgren, 1865, p. 71, pl. 9, fig. 7.—Verrill, 1881, p. 319.—Not *Polynoë impar* Johnston, 1839.

Polynoë impar Théel, 1879, pp. 9, 15.—Not Johnston, 1839.

Harmothoë (*Evarne*) *fragilis* Moore, 1910, p. 353, pl. 29, figs. 29, 30, pl. 30, figs. 31–33.

Harmothoë impar Ditlevsen, 1917, p. 12, fig. 1, pl. 2, fig. 16, pl. 3, fig. 11.—Not Fauvel, 1923, p. 59, fig. 21,*a–f*.—Uschakov, 1955, p. 157, fig. 41.—Pettibone, 1956a, p. 550.—Eliason, 1962, p. 217.—Not *Polynoë impar* Johnston, 1839.

Evarnella fragilis Hartman, 1959a, p. 75; 1960b, p. 79.

Description.—Length up to 26 mm., width including setae up to 12 mm., segments 37–41. Prostomium with cephalic peaks prominent, eyes large, anterior pair in region of greatest prostomial width.

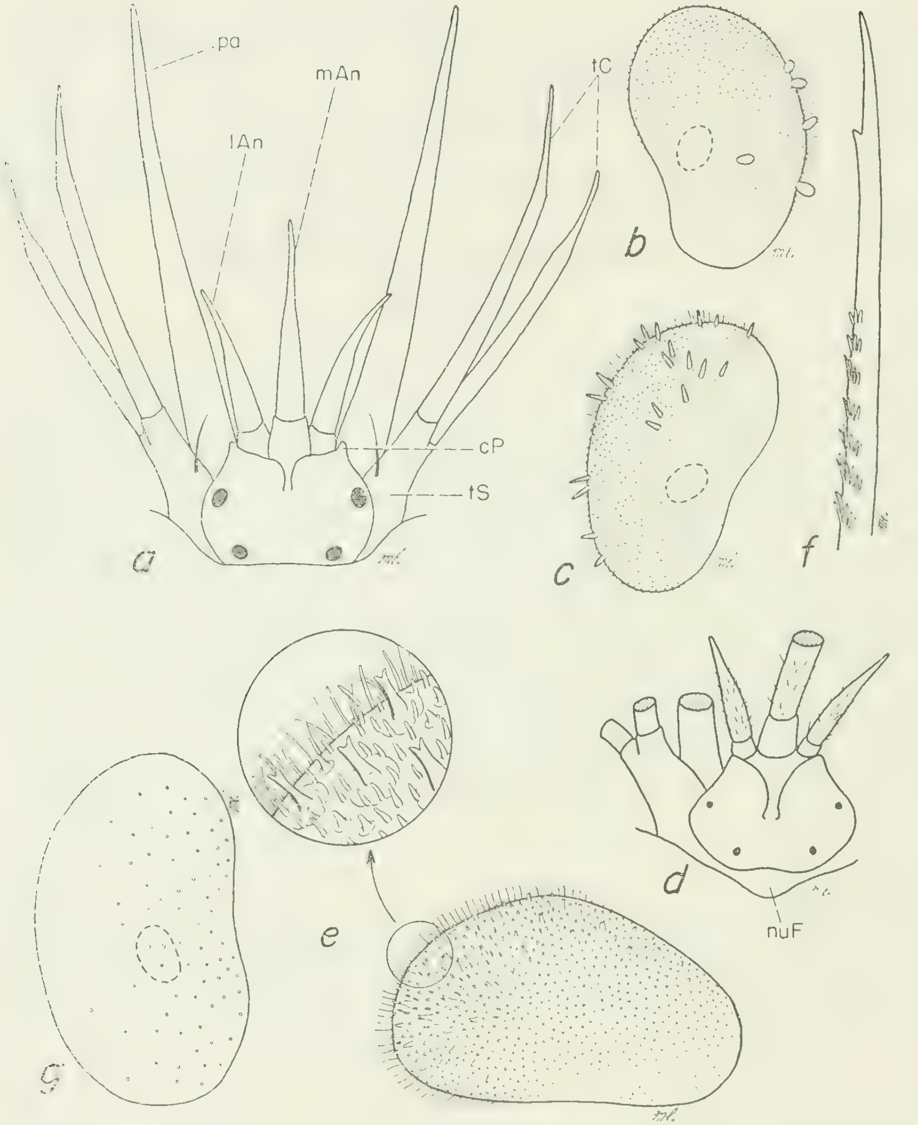

Figure 8.—Polynoidae, *a–c*, *Harmothoë extenuata: a*, dorsal view prostomium and tentacular segment; *b*, elytron of var. *propinqua; c*, elytron of var. *rarispina. d–f*, *Harmothoë macginitiei: d*, prostomium; *e*, elytron; *f*, tip of neuroseta. *g*, *Harmothoë dearborni*, elytron.

Body darkly pigmented dorsally, with wide transverse, somewhat interrupted brown bands. Elytra with mottled brownish coloration. Elytral microtubercles conical, hooked; soft macrotubercles near external border, not sharply set off from elytral surface, wide at base (may give border of elytra a scalloped effect).

Biology.—Dredged on mixed bottoms of gravel, mud, and sand.

Material examined.—Specimens from off Labrador, Nova Scotia, Maine, Massachusetts, in 20 to 112 fathoms.

DISTRIBUTION.—Widely distributed in the Arctic. Also Danish seas, Labrador to Massachusetts, southern California, north Japan Sea. In 1 to 1,611 fathoms.

Harmothoë (*Lagisca*) *extenuata* (Grube, 1840)

FIGURE 8,*a–c*

Lagisca rarispina Malmgren, 1865, p. 65, pl. 8, fig. 2.—Verrill, 1881, pp. 311, 314.—Webster and Benedict, 1884, p. 700; 1887, p. 709.—Whiteaves, 1901, p. 85.

Lagisca propinqua Malmgren, 1867, p. 9, pl. 1, fig. 3,*a–e*.—Verrill, *in* Smith, Harger, and Verrill, 1874, p. 20.

Lagisca rarispina var. *occidentalis* McIntosh, 1874, p. 262, pl. 9, figs. 1–4. Whiteaves, 1901, p. 86.

Lagisca impatiens Webster, 1886, p. 129, pl. 4, figs. 1–7.

Lagisca extenuata Fauvel, 1923, p. 76, fig. 28,*a–m*.—Støp-Bowitz, 1948a, p. 11, fig. 7.—Newell, 1954, p. 333.—Hartman, 1959a, p. 84.—Banse, 1959, p. 422.—Clark, 1960, p. 12.—Eliason, 1962, p. 222.

Harmothoe extenuata Pettibone, 1953, p. 31; 1954, p. 222; 1956a, p. 549.

Harmothoe rarispina Uschakov, 1955, p. 155, fig. 37.

DESCRIPTION.—Length up to 74 mm., width including setae up to 20 mm., segments 37–47. Prostomium with distinct cephalic peaks, anterior pair of eyes anterolateral, visible dorsally, slightly anterior to widest part of prostomium. Elytra with numerous conical microtubercles with tips blunt, pointed or bifid, with short fringe of papillae on external border; with or without additional macrotubercles—when present, distinctly set off from the elytral surface, usually narrower at the base, translucent to brownish, smooth, globular (var. *propinqua*, fig. 8,*b*), sausage-shaped or elongate fusiform (var. *rarispina*, fig. 8,*c*); macrotubercles variable in number, 0–9 near posterior border, 0–13 scattered near center of elytron.

Neurosetae with enlarged long spinous regions, with tips slightly hooked, with small secondary tooth present, as remnant only, or absent entirely (in var. *occidentalis* and var. *impatiens* only few neurosetae have a secondary tooth or remnant of one; in some absent entirely). Color: body irregularly pigmented dorsally, somewhat banded, brownish to grayish green; elytra variable in coloration, uniformly tan to mottled with brown, red, dark grey, yellow, sometimes with a darker or yellow spot near the elytrophore.

BIOLOGY.—An abundant and widely distributed species in the Arctic, North Atlantic, and North Pacific, found both intertidally and dredged at considerable depths. Often associated with two other common northern polynoids—*Lepidonotus squamatus* and *Harmothoë imbricata* (often confused and lumped with the latter species). Intertidally found under rocks, in rocky tide pools with algae, sponges, etc., in encrusting calcareous algae, among holdfasts and on fronds of kelp, as *Laminaria* (washed up on the beach after a storm along with *Laminaria*, *Fucus*, etc.); found on pilings among mussels, tunicates, sponges, hydroids, etc.; abundant on beds of *Mytilus edulis*. Third most abundant polynoid in the oceanographic fouling studies in the New England region. Dredged on all types of bottom—mud, rocks, shells, and various combinations of mud, sand, pebbles, rocks, gravel, stones, along with algae, shells, coral, sponges, bryozoan nodules, hydroids, barnacles, ascidians, mussels, and worm tubes.

Some females with coral pink eggs inside the body found in April (Fort Stark, New Hampshire, April 7, 1954); others with eggs extruded and carried between the parapodia and on the ventral surface (not on the dorsal surface as in *H. imbricata*).

Harmothoë extenuata, along with *H. imbricata*, appears to have great powers of dispersal and adaptation, showing great adaptability to bathymetric range—from tide pools to considerable depths (up to 1,000 fathoms). It appears to have even greater adaptability to temperature and salinity than does *H. imbricata*. Along the Labrador coast, it penetrates the Greater Lake Melville Estuary as well as the outer coast, while *H. imbricata* was not found in the Estuary (Pettibone, 1956a). It has been found in salt ponds of low salinity in Rhode Island (Charlestown Pond, May 13, 1954, H. P. Jeffries). It has been found in Chesapeake Bay (Pettibone, 1954).

MATERIAL EXAMINED.—Numerous specimens from Labrador, Gulf of St. Lawrence to off Delaware and Chesapeake Bay, intertidal to 705 fathoms.

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Faroes, Norway to Mediterranean and Adriatic, Hudson Bay to Chesapeake Bay, Bering Sea to southern California, north Japan Sea, South Africa. In low water to 1,000 fathoms.

Harmothoë (Eunoë) spinulosa (Verrill, 1879)

FIGURE 9,*e*, *f*

Eunoa spinulosa Verrill, 1879, p. 169.
Polynoë (Eunoa) spinulosa Verrill, 1881, pl. 7, fig. 6.
Eunoë spinulosa Hartman, 1942b, p. 24, figs. 19–22.

DESCRIPTION.—Length up to 43 mm., width including setae up to 16 mm., segments 46–49. Prostomium with distinct cephalic peaks. Elytra large, light colored, with numerous microtubercles—short, conical to elongate spinelike, with papillae scattered on surface and near edge. Neurosetae with long spinous regions and short bare hooked entire tips.

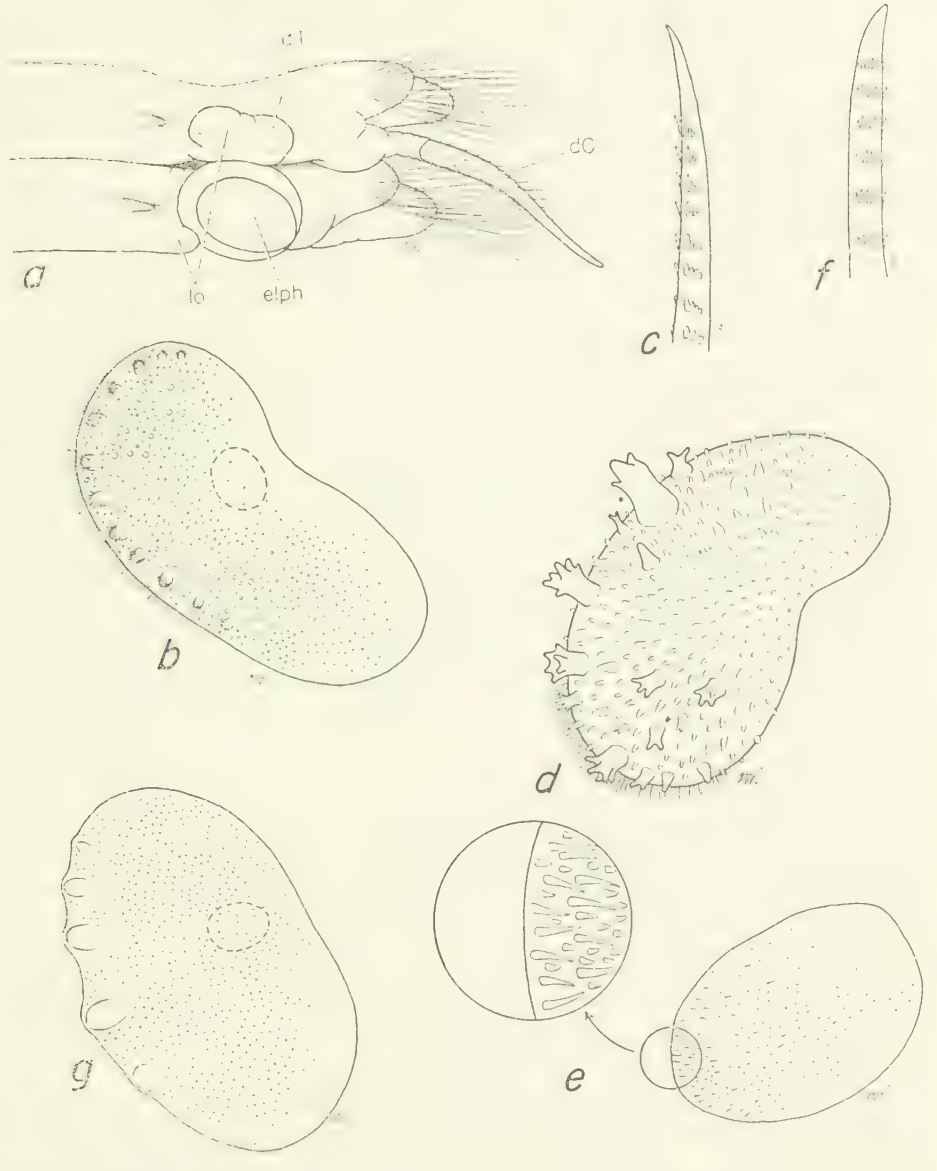

FIGURE 9.—Polynoidae, *a–c*, *Harmothoë nodosa: a*, dorsal view part of 2 segments showing extra lobes medial to dorsal tubercle and elytrophore; *b*, elytron; *c*, tip of neuroseta. *d*, *Harmothoë oerstedi*, elytron. *e–f*, *Harmothoë spinulosa: e*, elytron; *f*, tip of neuroseta. *g*, *Harmothoë fragilis*, elytron.

BIOLOGY.—Dredged in deeper waters.

MATERIAL EXAMINED.—Specimens from off Nova Scotia to off Martha's Vineyard, Massachusetts, 183 to 640 fathoms.

DISTRIBUTION.—Off Nova Scotia to Massachusetts. In 183 to 640 fathoms.

Harmothoë (*Eunoë*) *nodosa* (Sars, 1860)

FIGURE 9,*a–c*

Eunoë nodosa Malmgren, 1865, p. 64, pl. 8, fig. 4.—Procter, 1933, p. 135.—Pettibone, 1954, p. 217, fig. 26*c*; 1956a, p. 548.—Berkeley and Berkeley, 1956a, p. 234.—Uschakov, 1955, p. 152, figs. 34–35.

Eunoa nodosa Verrill, 1881, pp. 298, 303, 307, 311, 314.—Webster and Benedict, 1884, p. 700; 1887, p. 708.—Whiteaves, 1901, p. 86.

DESCRIPTION.—Length up to 90 mm., width including setae up to 39 mm., segments 36, 37. Prostomium with cephalic peaks short and blunt or lacking. Elytra with fringe of long papillae on external border; elytral microtubercles close set, low, flattened, semiglobose, some bifid; elytral macrotubercles confined mostly to a single row near external border, dark colored to pale yellow, nodular, with roughened tips or a fascicle of short spikes. Color: dorsal surface of body colorless or banded with olive brown; elytra yellow or tannish mottled with reddish brown.

BIOLOGY.—Dredged on bottoms of mud, stones, rubble, and various combinations of mud, sand, stones, pebbles, gravel, rocks, and shells.

MATERIAL EXAMINED.—Specimens from Labrador, Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, south Anticosti Island), Grand Manan, New Brunswick, Nova Scotia, Maine, Massachusetts, New Jersey, in 10 to 150 fathoms.

DISTRIBUTION.—Widely distributed in the Arctic. Also Bering Sea, north Japan Sea, Iceland, Scandinavian coasts to English Channel, Hudson Bay to New Jersey. In 10 to 690 fathoms.

Harmothoë (*Eunoë*) *oerstedi* (Malmgren, 1865)

FIGURE 9*d*

Eunoë oerstedi Malmgren, 1865, p. 61, pl. 8, fig. 3.—Sumner, Osburn, and Cole, 1913, p. 618.—Pettibone, 1953, p. 46, pl. 23; 1954, p. 219, fig. 26*d*; 1956a, p. 548.—Uschakov and Wu, 1959, p. 36.

Eunoa oerstedi Verrill, 1881, pp. 290, 303, 306, 307.

DESCRIPTION.—Length up to 80 mm., width including setae up to 30 mm., segments 37–42. Prostomium with cephalic peaks poorly developed or lacking. Elytra with lateral fringe of papillae, with numerous microtubercles one to many pronged; macrotubercles branched, extremely variable in size, number, arrangement, and shape, translucent or brownish. Color: dorsal surface dusky, dark or greenish black; elytra mottled with brown and grey.

BIOLOGY.—Found at low water in rocky tide pools (Sea Point near Kittery, Maine, June 27, 1958). Dredged on various types of bottom—mud, sand, pebbles, gravel, stones, rocks, rubble, with shells, coral, algae. Four specimens were obtained from the oceanographic fouling studies in the New England region (Gulf of Maine).

Material examined.—Specimens from Labrador, Nova Scotia, New Brunswick, Maine, Massachusetts, Rhode Island, in low water to 110 fathoms.

Distribution.—Widely distributed in the Arctic. Also Norway to English Channel, Labrador to Rhode Island, Bering Sea to central California, Yellow Sea, Japan. In low water to 516 fathoms.

Family Sigalionidae

Body usually long, narrow, cylindrical, vermiform, with numerous segments. Elytra numerous pairs, borne on knoblike elytrophores, on alternate segments in anterior region (segments 2, 4, 5, 7, etc.) and on all the segments of the posterior region (from segment 23 in *Pholoë* or segment 27 in *Sthenelais*, *Sigalion*, *Leanira*). Segments bearing no elytra have knoblike dorsal tubercles, without dorsal cirri (except sometimes on third segment). In the burrowing forms, which are found buried in mud or sand some centimeters below the surface (e.g., species of *Sigalion*, *Sthenelais*, *Leanira*), all segments except the anterior few have cirriform branchiae, ciliated on the inner border, on lateral sides of the elytrophores and dorsal tubercles hanging down below the elytra. On concave area between branchia and notopodium is a ciliated area, usually in the form of three cushions or ctenidia provided with long vibratile cilia. The branchiae and ciliated ctenidia thus form a ciliated groove along the laterodorsal parts of the body (fig. 10*c*). Also in these burrowing forms, the body is prismatic or tetrahedral in cross section, the paired ventral longitudinal muscles are well developed, forming a somewhat solelike ventral surface, the dorsal surface slightly arched.

Parapodia biramous, projecting laterally. Notopodia and neuropodia equally well developed, the notosetae forming a fanlike spreading bundle and curving dorsally. Notosetae simple, slender, tapering, spinous; neurosetae both simple and compound or all compound. With paired ventral cirri on all segments and a pair of anal cirri.

Prostomium suboval or subpentagonal, with usually 4 eyes (4, 2, or 0), 1 to 3 antennae, a pair of smooth ventral palps. Parapodial lobes of first or tentacular segment project anteriorly and dorsal to palps, more or less fused to anterior border of prostomium, with or without setae, with 2 pairs tentacular cirri (sometimes, in addition, lateral antennae of prostomium are fused basally to inner sides of tentacular segment). Muscular proboscis eversible, with a border of marginal papillae and four interlocking chitinous jaws. Carnivorous.

Key to the New England Genera of Sigalionidae

1. Without cirriform branchiae. Prostomium and tentacular segment with a single median antenna, 2 pairs similar tentacular cirri, a pair of rather short subulate palps, without setae (fig. 10*f*) . . . . **Pholoë** (p. 46)

   With cirriform branchiae on all segments except some anterior ones (fig. 10*c*). Prostomium with 1–3 antennae, a pair of long palps; tentacular segment with 2 pairs tentacular cirri, with numerous fine simple setae (fig. 11*a*) . . 2

2. Prostomium without a median antenna, with 2 small lateral antennae inserted anteriorly on prostomium (fig. 11*a*). Elytra with fringe of pinnately-branched papillae on external border (fig. 11*b*) . . . . . **Sigalion** (p. 48)

   Prostomium with a median antenna (fig. 10*b*); lateral antennae free only at tips, fused proximally to inner dorsal part of parapodial lobes of first or tentacular segment. Elytra with external border smooth or with simple fringe of papillae 3

3. Neurosetae of several kinds, some of which are compound, with terminal blades with bifid hooked tips (compound falcigers, fig. 10*d*). **Sthenelais** (p. 49)

   Most of neurosetae compound, with terminal blades with tips tapering, pointed (compound spinigers, fig. 10*e*); without compound falcigers. **Leanira** (p. 51)

Genus *Pholoë* Johnston, 1839

Type (monotypy): *Pholoë inornaia* Johnston, 1839; =*Pholoë minuta* Fabricius, 1780). Contains only one New England species.

Pholoë minuta (Fabricius, 1780)

FIGURE 10,*f–g*

Pholoë minuta Verrill, 1881, pp. 290, 295, 303, 307, 311, 314, pl. 7, fig. 4.—Webster and Benedict, 1884, p. 701; 1887, p. 709.—Whiteaves, 1901, p. 83.—Fauvel, 1923, p. 120, fig. 44,*a–h*.—Procter, 1933, p. 136.—Treadwell, 1948, p. 12, fig. 3*a*.—Miner, 1950, p. 311, pl. 101.—Pratt, 1951, p. 328.—Pettibone, 1953, p. 77, pl. 39; 1954, p. 230, fig. 26*f*; 1956a, p. 552.—Newell, 1954, p. 333.—Uschakov, 1955, p. 165, fig. 44.—Southward, 1956, p. 258.—Stickney, 1959, p. 15.—Clark, 1960, p. 15.—Day, 1960, p. 288.—Berkeley and Berkeley, 1961, p. 656.—Wesenberg-Lund, 1962, p. 34.—Eliason, 1962, p. 229.

DESCRIPTION.—Length up to 25 mm., width including setae up to 4 mm., segments 36–84. Body small, elongate, nearly linear, flattened dorsoventrally, fragmenting easily. Ventral surface and parapodial lobes with short papillae, usually covered with debris. Elytra numerous pairs, on all segments from segment 23 on, covering the dorsum except for a narrow middorsal part; elytral surface smooth, with few somewhat moniliform papillae on posterior border. Prostomium small, suboval, with 2 pairs large eyes, each pair closely approximated on each side, with single short subulate median antenna. Tentacular parapodial lobes with 2 pairs tentacular cirri similar to median antenna, without setae. A digitiform facial tubercle on a rounded lobe dorsal to mouth and ventral to prostomium (may be somewhat withdrawn). Notosetae simple, slender, curved to strongly

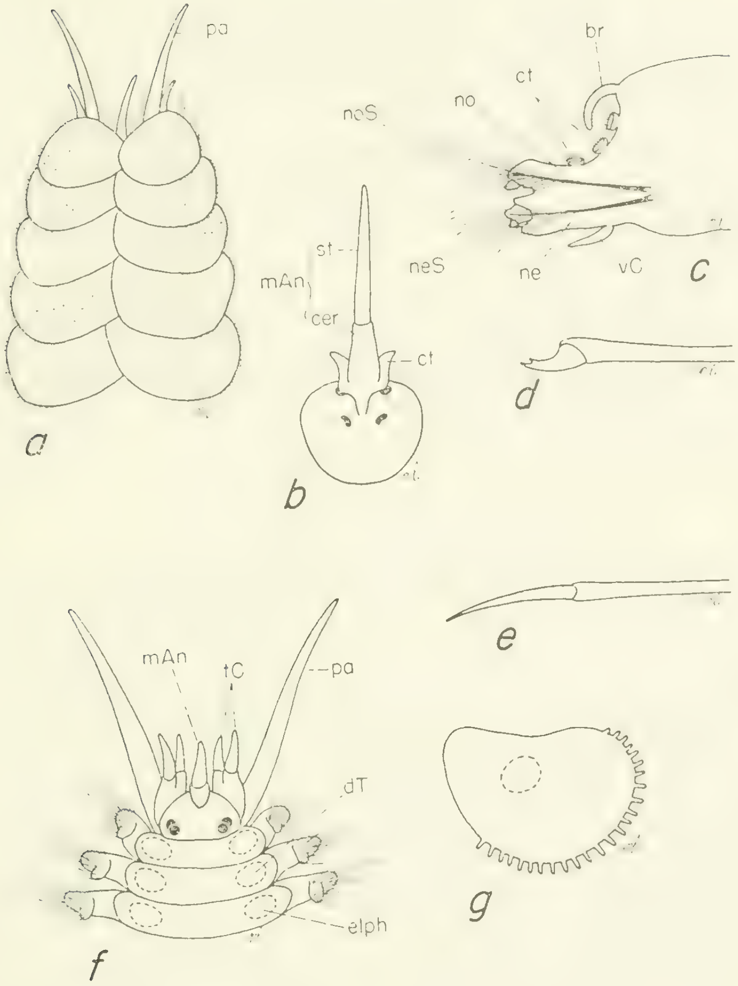

Figure 10.—Sigalionidae, *a–d*, *Sthenelais boa: a*, dorsal view anterior end; *b*, prostomium; *c*, parapodium; *d*, neuroseta (compound falciger, with bifid tip). *e*, *Leanira tetragona*, neuroseta (compound spiniger). *f–g*, *Pholoë minuta: f*, dorsal view anterior end, elytra removed; *g*, elytron.

angled. Neurosetae stouter, compound, with terminal blade short, hooked, entire. Color: without color or greenish gray, variegated brownish and black.

Biology.—In contrast to the other representatives of the family, it is not a burrowing form but is found under rocks, in crevices, among oysters, mussels, in holdfasts of algae (as *Laminaria*), in encrusting algae, etc. Dredged on various types of bottoms as stones, mud, and various combinations of mud, sand, gravel, stones, rocks, with shells, bryozoans, hydroids, mussels, worm tubes. According to Thorson (1946, p. 49), the species may reproduce all the year round and have a nonpelagic development.

MATERIAL EXAMINED.—Specimens from off Labrador, Gulf of St. Lawrence, Nova Scotia, Newfoundland, New Brunswick, Maine, New Hampshire, Massachusetts, Long Island Sound, in low water to 120 fathoms.

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Norway to France, Labrador to Long Island Sound, Bering Sea to central California, Chile, north Japan Sea, off South Africa. In low water to 1,254 fathoms.

Genus *Sigalion* (Audouin and Milne-Edwards, MS.) Cuvier, 1830

Type (designated by Hartman, 1959a, p. 118): *Sigalion mathildae* (Audouin and Milne-Edwards, MS.) Cuvier, 1830. Contains only one New England species.

Sigalion arenicola Verrill, 1879

FIGURE 11,*a,b*

Sigalion arenicola Verrill, 1879, p. 167; 1881, pp. 319, 320, pl. 7, fig. 5.—Webster and Benedict, 1884, p. 701.—Sumner, Osburn, and Cole, 1913, p. 619.—Hartman, 1942b, p. 34, fig. 44.—Miner, 1950, p. 311, pl. 101.

DESCRIPTION.—Length up to 300 mm., width including setae up to 8 mm., segments up to 300. Body elongated, squarish in cross section, tapered posteriorly. One of the paired anal cirri often very long and threadlike, the other short. Elytra numerous pairs, on all segments from segment 27 on, large, thin, transparent, subrectangular, smooth, without tubercles, with 8–13 pinnately branched papillae on lateral margin (2–8 pinnae on each side plus a few short filaments along the base; fig. 11*b*). Prostomium subpentagonal, with 4 small eyes arranged in rectangle near middle, with 2 small lateral antennae on anterior side, without median antenna. Parapodial lobes of tentacular segment project anteriorly, lateral and dorsal to bases of the long slender palps, fused to anterior side of prostomium, with 2 pairs subequal tentacular cirri and numerous setae.

A small pair of dorsal cirri on segment 3. Cirriform branchiae on all segments beginning with segment 5; with 3 parapodial ctenidia above the notopodium. Biramous parapodia with lobes well separated; notopodium club shaped, with single digitiform process or stylode on dorsoanterior side; neuropodium somewhat bilobed, upper part (with aciculum) longer, with 2 short rounded stylodes on posterior side of neuropodium (the upper one longer, the lower one shorter, almost disappearing in more posterior segments).

Notosetae long, delicate, flowing, curving inward over dorsum, simple, tapering to capillary tips. Neurosetae of several kinds (see pl. 7, fig. 5, in Verrill, 1881): Upper few simple, bipinnate, with acute tips; rest compound, some having short terminal blades with bifid hooked tips and with shafts strongly to faintly spinous distally; others having long, pseudoarticulated terminal blades with bifid hooked tips and with distal part of shafts spinous, ringed, or smooth. Color: delicate flesh color, translucent.

Biology.—Found intertidally burrowing in loose sand, gravelly sand, muddy sand, and clay. Dredged on bottoms of sand with shell fragments and stones.

Material examined.—Massachusetts (Cape Cod, Provincetown, Truro, Wellfleet, Barnstable; Nobska, Woods Hole; Edgartown, Martha's Vineyard), Connecticut, Long Island Sound, Georgia (Sapelo Island), in low water to 19 fathoms.

Distribution.—Massachusetts (Cape Cod) to Georgia. In low water to 20 fathoms.

Genus *Sthenelais* Kinberg, 1855

Type (monotypy): *Sthenelais helenae* Kinberg, 1855.

Both species burrowing forms, with the body prismatic in cross section, flattened ventrally, convex dorsally, tapering gradually posteriorly. Without dorsal cirri on segment 3, with 2 medium long anal cirri, with ventral cirri about the length of the neuropodia. Elytra numerous pairs, imbricated, covering the dorsum. Prostomium suboval, with rounded ciliated nuchal organs at posterior angles. Four eyes arranged in square near the base of the median antenna, the anterior pair partly hidden. Median antenna with stout ceratophore which has a pair of antennal ctenidia attached basally and flaring distally (fig. 10*b*); style of median antenna rather long, tapering, smooth; paired palps very long, tapering, smooth.

Tentacular segment with dorsal pair tentacular cirri about same length as median antenna and a shorter ventral pair, with numerous fine setae; with a pair of small prostomial lateral antennae fused basally to the inner dorsal part; with a pair of medial buccal ctenidia composed of a foliaceous plate medial to the tentacular cirri and forming a short delicate sheath or sleeve around the base of the palps. Cirriform branchiae begin on segment 4; with parapodial ctenidia in groups of 3 in the concave area above the notopodia (fig. 10*c*). Notopodia with fringe of short to long papillae (parapodial stylodes), with numerous setae curving dorsally; notosetae simple, capillary, finely spinous. Neuropodia with conical acicular lobes surrounded by parapodial bracts with fringes of papillae.

Neurosetae of several kinds: (1) Upper group of few setae simple, spirally spinulate, tapering to fine tips; (2) a horseshoe-shaped middle group of compound setae around the acicular lobe, some or all of which have the terminal blades short and bifid hooked (compound falcigers, fig. 10*d*); (3) a group of compound setae arranged anterior and ventral to group (2), with slender shafts, with terminal blades long, slender, sometimes pseudoarticulated, with fine bifid hooked tips.

Key to the New England Species of *Sthenelais*

1. Anterior elytra with simple and bifid fringe on external border (fig. 11*c*); middle (after segment 12 or so) and posterior elytra without fringe but with a deep notch on the external side (fig. 11*d*); elytra thin, translucent, delicate, smooth, without microtubercles. Parapodial stylodes (fingerlike fringe of papillae on parapodial tips) of anterior segments long and prominent (fig. 11*e*). Middle group of neurosetae composed of only a few compound falcigers with terminal blades short and with bifid hooked tips; most consist of compound neurosetae with terminal blades tapering to pointed tips, with blades long to short (compound spinigers; longer blades may be pseudoarticulated). **S. limicola**

All elytra with simple fringe on external border, elytra thicker, opaque, with microtubercles. Parapodial stylodes short. Middle group of neurosetae composed of numerous stout compound falcigers, with terminal blades short and with bifid hooked tips (fig. 10*d*). . . . . **S. boa**

Sthenelais boa (Johnston, 1833)

FIGURE 10,*a-d*

Sthenelais picta Verrill, 1881, pp. 291, 300, 317, 320, 321, pl. 6, fig. 7, pl. 7, fig. 3.—Webster and Benedict, 1884, p. 701.—Wilson, 1900, p. 351.—Sumner, Osburn, and Cole, 1913, p. 618.

Sthenelais boa Fauvel, 1923, p. 110, fig. 41,*a-l*; 1933, p. 13; 1953, p. 61, fig. 28,*a-k*; 1957a, p. 4.—Monro, 1933a, p. 246, fig. 1.—Wesenberg-Lund, 1949, p. 257.—Day, 1953, p. 406; 1960, p. 289.—Tebble, 1955, p. 76.—Renaud, 1956, p. 6, fig. 4.—Uschakov and Wu, 1959, p. 37.—Fauvel and Rullier, 1959, p. 503.—Clark, 1960, p. 14.

Sthenelais leidyi Hartman, 1942b, p. 30, figs. 36-39; 1945, p. 10; 1959a, p. 120.—Pratt, 1951, p. 328.—Costello, et al., 1957, p. 98.

Sthenelais articulata Hartman, 1951, p. 20.

DESCRIPTION.—Length up to 200 mm., width including setae up to 5 mm., segments up to 200 or more. Elytra subreniform or broadly lunate, with a deep emargination in center of anterior border. Complete surface of anterior few elytra covered with microtubercles (small rounded, slightly obtuse); on more posterior elytra, microtubercles confined to anterior part and along lateral border. Color: elytra variable in color, mottled greyish on inner part, forming a wide middorsal longitudinal band; irregularly mottled greyish on most of elytra with darker brown on middorsal part; mottled with darker bands on posterior and inner borders of elytra; sometimes with rusty extraneous material on elytra and setae.

BIOLOGY.—A rather sluggish form but can burrow with rapidity. Found intertidally in sand, muddy sand, and in sand with gravel. Dredged on silty sand and shelly bottom. Ripe individuals found during the middle and latter part of August in Massachusetts (Woods Hole region, Bumpus, 1898b).

MATERIAL EXAMINED.—Massachusetts (Cape Cod, Vineyard Sound, off Martha's Vineyard, Nantucket Sound), Rhode Island, Long Island Sound, North Carolina, Georgia, Louisiana, Florida, in low water to 9 fathoms.

DISTRIBUTION.—Massachusetts (Cape Cod) to Brazil, Gulf of Mexico from Florida to Texas, Norway to Mediterranean, Adriatic, Iranian Gulf, Red Sea, Indian Ocean, Japan, China, off west and south Africa. In low water to 80 fathoms.

Sthenelais limicola (Ehlers, 1864)

FIGURE 11,*c–e*

Sthenelais gracilis Verrill, 1879, p. 166.—Sumner, Osburn, and Cole, 1913, p. 619.—Hartman, 1942b, p. 28, figs. 32–35; 1959a, p. 120.

Sthenelais emertoni Verrill, 1879, p. 166; 1881, pp. 314, 319, 320, pl. 7, figs. 1, 2.—Miner, 1950, p. 310, pl. 101.

Sthenelais limicola Whiteaves, 1901, p. 84.—Fauvel, 1923, p. 113, fig. 42,*a–g*.—Treadwell, 1948, p. 13, fig. 3*b*.—Miner, 1950, p. 310, pl. 101.—Tebble, 1955, p. 76.—Clark, 1960, p. 14.—Day, 1960, p. 289.—Eliason, 1962, p. 229.

DESCRIPTION.—Length up to 100 mm., width including setae up to 4 mm., segments up to 200 or more. Color: elytra translucent, colorless.

BIOLOGY.—Found at low water on sandy bottom (Kittery, Maine). Dredged on sandy and muddy bottoms. Tossed on the shore in large numbers during storms and eaten by cod and flounders (McIntosh, 1900). Found in stomach of haddock (Georges Bank, April 1953, R. Wigley).

MATERIAL EXAMINED.—Maine (Sea Point near Kittery, low water), Massachusetts (Quisset, Gloucester, Georges Bank), Connecticut (Noank), Rhode Island (Newport), Long Island Sound (Fishers Island), North Carolina, in low water to 42 fathoms.

DISTRIBUTION.—Gulf of St. Lawrence to North Carolina, Norway to Mediterranean, Adriatic, West and South Africa. Low water to 420 fathoms.

Genus *Leanira* Kinberg, 1855

Type (monotypy): *Leanira quatrefagesi* Kinberg, 1855.

Both species are burrowing forms, similar in shape to *Sthenelais*. Elytra numerous pairs, thin, translucent, smooth, without tubercles. Palps and tentacular segment as in *Sthenelais*. Notopodia with fringe of cirriform papillae (parapodial stylodes), with numerous setae curving dorsally; notosetae simple, capillary, finely spinous. Neuropodia also with parapodial stylodes; neurosetae mostly compound, with

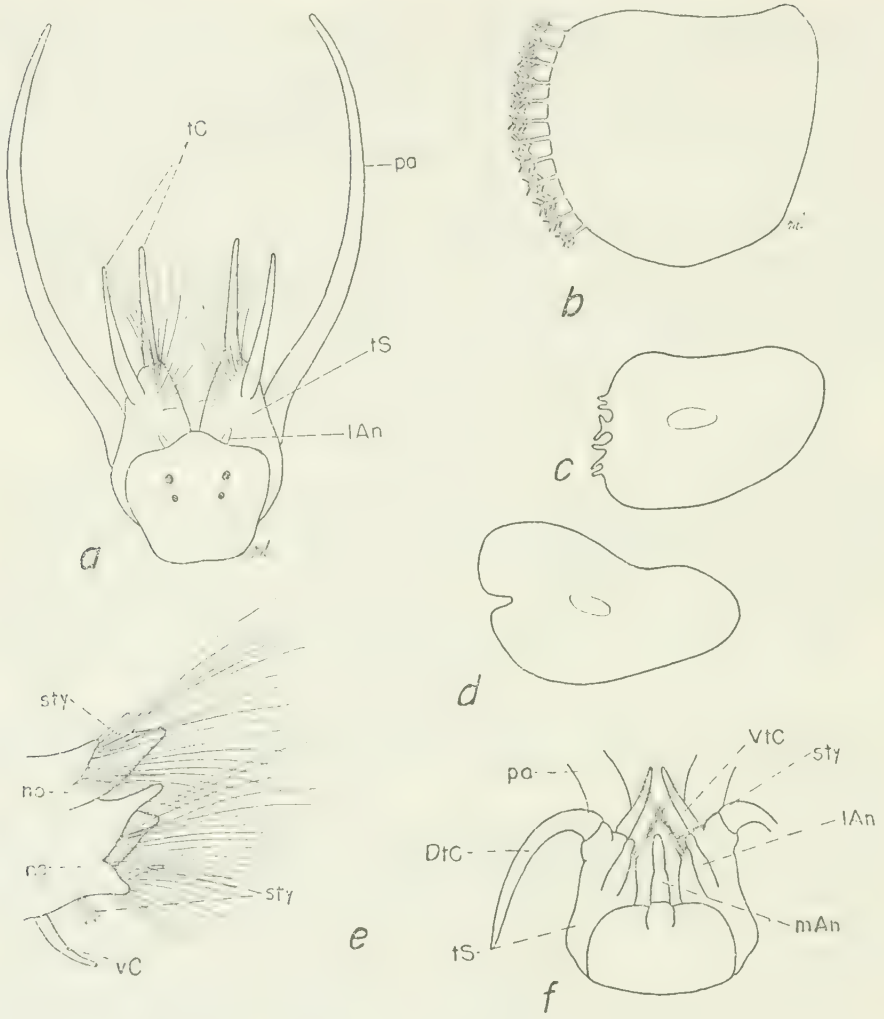

FIGURE 11.—Sigalionidae, *a–b*, *Sigalion arenicola: a*, dorsal view prostomium and tentacular segment; *b*, elytron. *c–e*, *Sthenelais limicola: c*, left anterior elytron; *d*, left middle elytron; *e*, anterior parapodium, posterior view. *f*, *Leanira hystricis*, prostomium and tentacular segment (only bases of palps shown).

stems smooth or somewhat spiny, with terminal blades subulate, transversely canaliculated, tapering to delicate attenuated tips (compound spinigers, fig. 10*e*); may be few additional simple, spinous, pointed neurosetae (easily overlooked).

Key to the New England Species of *Leanira*

1. With pair of long dorsal cirri on segment 3 (extending to about tips of setae). Elytra with fringe of delicate papillae on lateral borders. Median antenna with pair of auricular ctenidia on ceratophore; style long and slender. **L. tetragona**

Without dorsal cirri on segment 3. Elytra without lateral fringe; some of more posterior elytra may have shallow lateral incision. Median antenna without antennal ctenidia on short ceratophore; style short (about same length as prostomium; fig. 11*f*) . . . . **L. hystricis**

Leanira tetragona (Oersted, 1845a)

FIGURE 10*e*

Leanira tetragona Verrill, 1881, pp. 304, 307.—Whiteaves, 1901, p. 84.—Fauvel, 1923, p. 117, fig. 43,*a–g*.—Wesenberg-Lund, 1951, p. 21.—Clark, 1960, p. 14.—Eliason, 1962, p. 223.

DESCRIPTION.—Length up to 200 mm., width including setae up to 8 mm., segments up to 300 or more. Prostomium rounded, bilobed, without eyes. Cirriform branchiae begin on segment 6 (rudimentary ones on 4, 5); with parapodial ctenidia in groups of 3 in the concave area above the notopodia.

BIOLOGY.—Dredged on bottoms of mud, mud and sand, sand and stones, rocks, with red algae. A female with large yolky eggs in body was found in plankton (*Grampus* Station 10249, 42°37′ N., 69°38′ W., 125–0 fathoms, August 22, 1914). Found in stomach of haddock (Georges Bank, January 1954, R. Wigley).

MATERIAL EXAMINED.—Gulf of St. Lawrence (south of Anticosti Island), Gulf of Maine, Georges Bank, Massachusetts, to off Chesapeake Bay, in 22 to 906 fathoms; also in plankton, 125–0 fathoms.

DISTRIBUTION.—Scattered records in the Arctic (Davis Strait, Siberian Arctic). Also Gulf of St. Lawrence to off Chesapeake Bay, Iceland, Norway to Azores, Mediterranean, Adriatic. In 22 to 1,200 fathoms.

Leanira hystricis Ehlers, 1875

FIGURE 11*f*

Leanira robusta Verrill, 1885a, pl. 40, fig. 175; 1885b, p. 426.—Hartman, 1942c, p. 104, fig. 8*a*; 1944a, p. 337, pl. 14, fig. 10.

Leanira alba Moore, 1910, p. 387, pl. 33, figs. 99–104.

Leanira hystricis Fauvel, 1923, p. 118, fig. 43,*h–m*.—Hartman, 1942c, p. 105.—Miner, 1950, p. 312, pl. 102.—Wesenberg-Lund, 1951, p. 21.

DESCRIPTION.—Length up to 100 mm. or more (largest specimens broken and incomplete), width including setae up to 9 mm., segments up to 60 or more. Prostomium rounded, without eyes (if present, deeply buried). Cirriform branchiae begin on about segments 21–27 (may be small rudimentary ones more anteriorly); parapodial ctenidia in the concave area above the notopodia form an almost continuous ciliated area.

BIOLOGY.—Dredged on bottoms of mud.

MATERIAL EXAMINED.—Massachusetts (Martha's Vineyard), off Rhode Island, north of Puerto Rico, off southern California (San Diego), in 100 to 646 fathoms.

Distribution.—Off Massachusetts to north of Puerto Rico, Iceland, Great Britain, Ireland, Azores, off Southern California. In 100 to 1,443 fathoms.

Family Chrysopetalidae

Body short or elongated, segments few or numerous. Prostomium distinct, with usually 3 antennae, 2 ventral palps, 4 eyes (0, 2, or 4). Tentacular segments more or less fused with prostomium, with 1 to 4 pairs tentacular cirri. Parapodia biramous; notosetae in lateral tufts, curving dorsally and forming fan-shaped groups or transverse rows; notosetae simple, usually expanded to form paddlelike setae or paleae (exception: *Dysponetus*). Neurosetae compound. With dorsal and ventral cirri. Proboscis strongly muscular, usually provided with a pair of chitinous stylets.

Contains only one New England genus.

Genus *Dysponetus* Levinsen, 1879

Taphus Webster and Benedict, 1887; type (monotypy): *Taphus hebes* Webster and Benedict, 1887; =*Dysponetus pygmaeus* Levinsen, 1879.

Type (monotypy): *Dysponetus pygmaeus* Levinsen, 1879. Contains only one species.

Dysponetus pygmaeus Levinsen, 1879

Figure 12

Dysponetus pygmaeus Levinsen, 1879, p. 9, pl. 1, figs. 1–6.—Annenkova, 1935, p. 233; 1938, p. 138.—Wesenberg-Lund, 1950b, p. 64; 1953, p. 47.—Uschakov, 1955, p. 168, fig. 45.

Taphus hebes Webster and Benedict, 1887, p. 716, pl. 8, figs. 113–118.

Description.—Length up to 3 mm., width up to 1.5 mm., segments 11–15. Body minute, elongate ovate, widest in the middle, convex dorsally and ventrally. Prostomium may be sunk between the first pair of parapodia, oval, with 3 short elliptical antennae on anterior margin, a pair of short globular ventral palps, without eyes or a minute pair visible when living. Tentacular segment indistinct, with a pair of tentacular cirri just posterior to prostomium, similar to antennae. First 2 setigers with dorsal cirri and notosetae only. Parapodia distinctly biramous from setiger 3 on. Notopodia indistinct, with a radiating bundle of numerous notosetae emerging dorsolaterally from body, curving dorsally and posteriorly. Notosetae dark brownish, simple, curved, transversely striated, with few stout scattered spines along convex margin (notosetae do not form expanded paleae as in other chrysopetalids). Dorsal cirri with bulbous cirrophores below the notosetae; styles rather thick, digitiform, extending about the length of the notosetae.

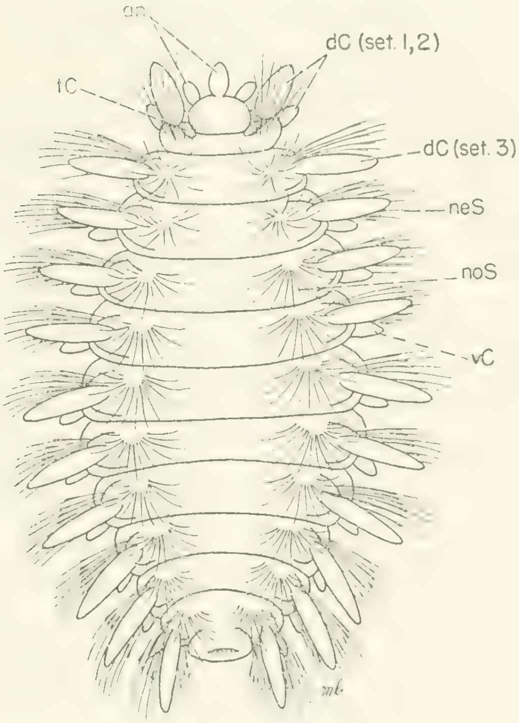

Figure 12.—Chrysopetalidae, *Dysponetus pygmaeus*, dorsal view animal (drawn from type slide of *Taphus hebes* Webster and Benedict).

Neuropodia short, conical; neurosetae little longer than notosetae, compound, with stem transversely striated; blade quite long, delicate, with slightly curved tip. Ventral cirri short, conical. Anal segment prolonged into conical cirriform structure. Proboscis muscular, with 2 maxillary pieces in the form of stylets.

Biology.—Dredged on sandy bottom. Found in holdfasts of *Laminaria*.

Material examined.—Type of *Taphus hebes* from Eastport, Maine.

Distribution.—East and west Greenland, Spitsbergen, Maine (Eastport), north Japan Sea. Low water to 28 fathoms.

Family Amphinomidae

Most species of the family tropical and subtropical. Some common in the littoral zones in the West Indies and occasional individuals carried to more northern regions by the Gulf Stream and other currents along the shore, for example *Amphinome rostrata;* others apparently confined to floating objects, as *Hipponoë gaudichaudi*. A few species typically northern in range. The amphinomids commonly called "fire-worms," an allusion to the stinging sensation caused by touching the specimens—a mechanical injury from penetration of numerous, fine, glasslike, harpoon-shaped setae, which are difficult to remove. Often brilliantly colored.

Body short, flattened, fusiform, or moderately elongated, vermiform, subcylindrical or subquadrangular in cross section. Prostomium suboval, with 5 similar, short, subulate to filiform appendages (median antenna in middle, paired lateral antennae more anteriorly, paired palps more laterally), usually with eyes (0, 2, or 4). Usually with characteristic prostomial caruncle or crest, a posterior extension of the prostomium with ciliated bands; caruncle may be absent or very primitive, small cordiform, simple sinuous ridge extending over several segments (fig. 13*c*), or exceedingly elaborate with more or less convoluted dorsal and ventral lobes.

Parapodia biramous, cylindrical, with rami well separated. Setae simple, some capillary, spear shaped, harpoon shaped, bifurcated (with basal spur), or hooked; setae sometimes hollow and filled with a poisonous jelly. Dorsal cirri posterior to notosetae; ventral cirri ventral and posterior to neurosetae. Branchiae paired, branched (arborescent or pinnate), posterior to bases of notopodia, continued along length of body or confined to the anterior region. Mouth ventral, surrounded by first few setigers. Anus terminal or subterminal, covered by median oval papilla or with two short anal cirri. Proboscis eversible, short, globular to cylindrical, lacking papillae and jaws.

Predaceous, sluggish in movement, crawling around on rocks, in crevices, among corals, concealing themselves in retreats which they rarely leave; some found on floating timber, algae, debris, etc.

Key to the New England Genera of Amphinomidae

1. Body flattened, fusiform, short (up to 30 segments). Neuropodia ventral in position, with few stout bifid hooked, clinging setae; ventral cirri reduced to short cushions ventral to neurosetae (fig. 13*b*) . . . . **Hipponoë** (p. 57)

   Body subcylindrical or subrectangular in cross section, slightly tapered toward both ends, moderately elongate. Neuropodia lateral in position; ventral cirri short, subulate (fig. 13*c*) 2

2. Body subrectangular in cross section. Neuropodium with few, stout, hooked setae (fig. 13*e*). Prostomial caruncle cordiform, extending on first setiger (fig. 13*d*) . . . . **Amphinome** (p. 59)

   Body subcylindrical in cross section. Neuropodium without hooked setae. Prostomial caruncle absent or otherwise 3

3. Branchiae begin on setiger 2, continuing posteriorly. Without hooked setae in notopodia of first setiger. Prostomial caruncle a simple sinuous crest extending on first 3 setigers (fig. 13*c*) . . . . **Pareurythoë** (p. 60)

   Branchiae begin on setigers 3 or 4, confined to anterior part of body. With 2 hooked setae in notopodia of first setiger. Prostomial caruncle absent or poorly developed . . . . **Paramphinome** (p. 61)

Genus *Hipponoë* Audouin and Milne-Edwards, 1830

Metamphinome Treadwell, 1940; type (monotypy): *Metamphinome multibranchiata* Treadwell, 1940; =*H. gaudichaudi* Audouin and Milne-Edwards, 1830.

Type (monotypy): *Hipponoë gaudichaudi* Audouin and Milne-Edwards, 1830. Contains only one New England species.

Hipponoë gaudichaudi Audouin and Milne-Edwards, 1830

FIGURE 13,*a*,*b*

Hipponoë gaudichaudi Moore, 1903b, p. 793.—Willey, 1910, p. 180.—Sumner, Osburn, and Cole, 1913, p. 619.—Augener, 1922, p. 39.—Fauvel, 1923, p. 132, fig. 47,*l–p;* 1936b, p. 19.—Støp-Bowitz, 1948a, p. 15.—Okuda, 1950, p. 49, figs. *a–b*.—Fauvel and Rullier, 1959, p. 510.

Hipponoë multibranchiata Hartman, 1951, p. 29, pl. 8, figs. 1–2.

DESCRIPTION.—Length up to 42 mm., width up to 10 mm., segments 25–32. Prostomium small, suboval, with 4 subequal eyes arranged in rectangle (rarely missing?), with 5 filiform appendages—subequal paired lateral antennae and lateral palps; median antenna longer (fig. 13*a*). Without prostomial caruncle. Branchiae arborescent, richly branched, beginning on setiger 3 and continuing posteriorly. Dorsal cirri digitiform, nearly as long as notosetae. Ventral cirri reduced to short cushions ventral to neurosetae. Notopodia dorsolateral in position, with fan-shaped bundle of slender, fine notosetae (fig. 13*a*). Neuropodia ventral in position about midway between midventral line and lateral side, with circular rim within which are a group of short, stout, bifid hooked neurosetae (with long terminal hook and shorter one beneath, fig. 13*b*). Color, in life: deep orange to vermilion red.

BIOLOGY.—Floating objects apparently the normal habitat of the species. Found clinging to logs or floating objects bearing masses of goose or stalked barnacles (as *Lepas anatifera* Linné, *L. fascicularis* Ellis and Solander, *L. f. aurivillii* Nilsson-Cantell, *L. pectinata* Spengle, *L. ansifera* Linné) upon which they feed. According to Moore (1903b), they are found on the under side of logs away from the light, associated with crabs and nudibranchs, and less frequently on the sides and upper surfaces of barnacles. Cling most tenaciously by means of their strong neuropodial hooks and move very sluggishly. Found within the valves of *Lepas*. Okuda (1950) recorded a female distended with ova, living commensally within the branchial chamber of *Lepas*. Sexually mature individuals taken in the summer in the Woods Hole area (Sumner, 1913). They have a rich uniform pinkish coloration resembling the color of the egg ribbons of the *Lepas* (Willey, 1910). Young remain attached to the lateral and ventral sides of the female at one time considered to be parasites (Augener, 1922). Specimens

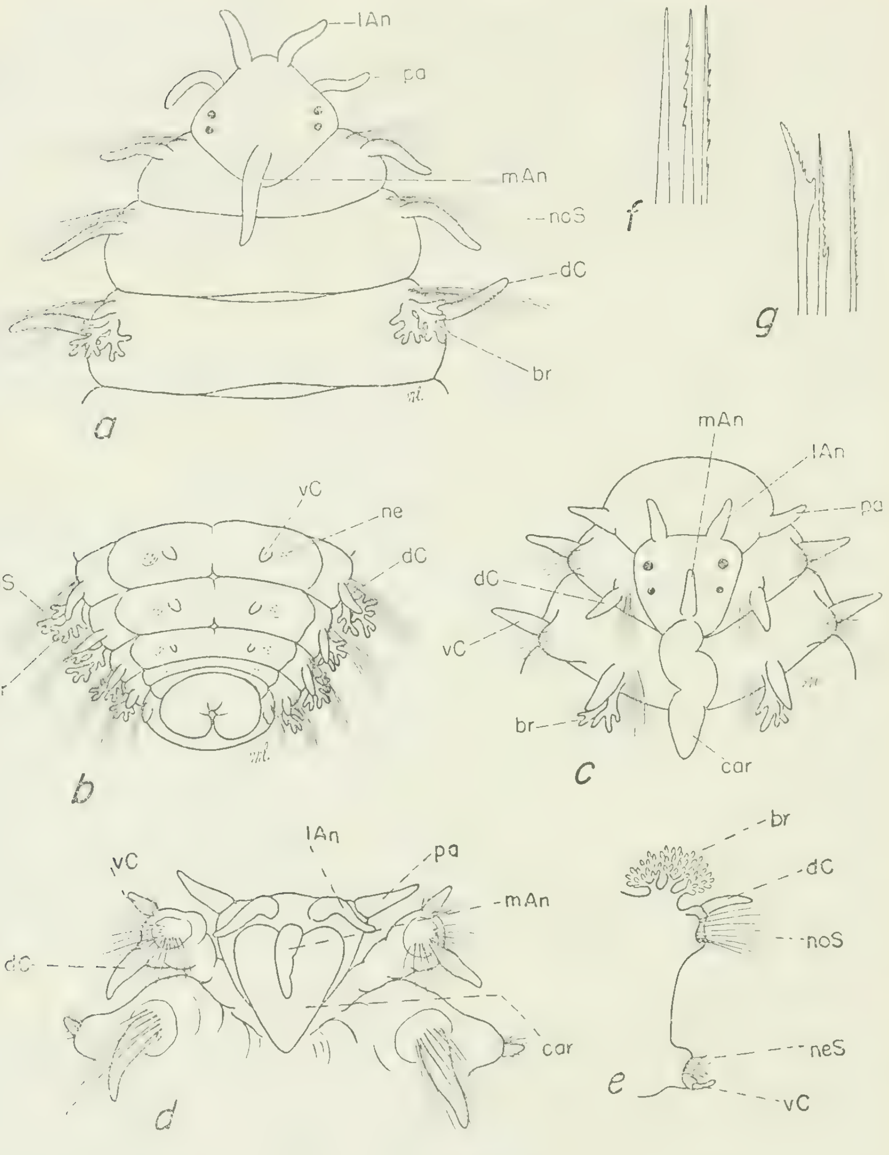
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FIGURE 13.—Amphinomidae, *a–b*, *Hipponoë gaudichaudi: a*, dorsal view anterior end; *b*, ventral view posterior end. *c*, *Pareurythoë borealis*, dorsal view anterior end. *d–e*, *Amphinome rostrata* (after Hartman, 1951 and Fauvel, 1923): *d*, dorsal view anterior end; *e*, parapodium. *f–g*, *Paramphinome pulchella* (after Gustafson, 1930): *f*, notosetae; *g*, neurosetae.

with young attached to the body found in the North Pacific in April and May (D. Henry, collector).

MATERIAL EXAMINED.—North Atlantic (*Albatross* Station 1655, Gulf Stream, surface, with young attached laterally to female), North Pacific (off southern California, 30°50′ N., 121°35′ W., May 29, 1954, in *Lepas fascicularis aurivillii*, with young; 28°40′ N., 129°35′ W., June 1955, larger and smaller specimens in *L. anatifera*; 27°56′ N., 129°35′ W., April 23, 1954, in *L. anatifera* and *L. f. aurivillii*, with young; 26°12′ N., 118°27′ W., August 24, 1954, in *L. f. aurivillii*, barnacles from Scripps material, collected by M. Johnson, identified by D. Henry).

Distribution.—Cosmopolitan, on floating objects: North Atlantic (Massachusetts, Florida, near Bermuda, West Indies, Gulf of Mexico, S.W. Ireland, Madeira, France), Mediterranean, South Atlantic (St. Helena, West Africa), North Pacific (Japan, off southern California), South Pacific (Port Jackson, Australia), Indian Ocean (Ceylon).

Genus *Amphinome* Bruguière, 1789

Type (designated by Baird, 1870): *Amphinome tetraedra* Bruguière, 1789; =*A. rostrata* (Pallas, 1766). Contains only one New England species.

Amphinome rostrata (Pallas, 1766)

Figure 13,*d*,*e*

? *Amphinome lepadis* Verrill, 1885b, p. 427.—Hartman, 1944a, p. 337, pl. 23, fig. 3.

Amphinome pallasii Wilson, 1910, p. 351.—Moore, 1903b, p. 793.—Fauvel, 1923, p. 127, fig. 46.

Amphinome rostrata Willey, 1910, p. 180.—Augener, 1922, p. 39.—Okuda, 1938, p. 78.—Hartman, 1951, p. 22, pl. 4, fig. 1.—Day, 1953, p. 408.—Fauvel, 1955, p. 81, fig. 37.—Rioja, 1958, p. 223.

Description.—Length up to 400 mm., width up to 30 mm., segments 49–66. Prostomium wedged between setigerous lobes of first segment, small, rounded, may be slightly bilobed anteriorly, with 5 subequal short subulate appendages (median antenna in middle, lateral antennae anteriorly, palps lateroventral), with 2 eyes (?). Prostomial caruncle small, cordiform, just posterior to median antenna and extending on first setiger. Paired branchiae large, bushy, arborescent, branching dicotymously many times, beginning on setiger 3 (or setiger 2) and continuing posteriorly. Dorsal cirri digitiform, ventral cirri short, subulate. Some notosetae with fine capillary tips, others harpoon shaped. Neurosetae few in number (5–7), short, stout, hooked. Anus large circular opening embracing several segments. Color, in life: body bluish brown or bluish grey; cirri and branchiae deep brown or red with orange tips.

Biology.—The species is a common annelid in the littoral zone of the West Indies. Found on floating logs, driftwood and other debris, associated with stalked or goose barnacles, as *Lepas anatifera*, upon which the worm feeds. Coloration suggests a protective resemblance to the stalks of the barnacles to which it clings. Observed squeezing between the valves of the barnacles and feeding on the soft parts (Moore, 1903b). Observed continually crawling in and out of *Teredo* burrows (Verrill, 1885b). Also found on floating cuttlebone in company with *Lepas* and small gastropods, on fronds of algae, as the gulfweed *Sargassum*. Thus should be considered a tropical form that becomes a Gulf Stream pelagic waif. Occasionally dredged. Females show brood care, the young attached to the adult. Worm 90 mm. long found with 20 young on its body, ranging in length from 3 to 10 mm. (Augener, 1922). On a specimen (in the U.S. National Museum) from off the Philippine Islands found on driftwood, young specimens were wrapped around the parapodia near the branchiae—large enough to resemble the adult. Young immature specimens have been found on floating objects.

MATERIAL EXAMINED.—North Atlantic (Nantucket Sound, off Falmouth Heights, Massachusetts, 5 fathoms, June 18, 1950, J. Rankin; Vineyard Sound near Lucas shoal, among *Lepas* on log, September 4, 1959, M. Gray; *Albatross* Station 2566, 37°23′ N., 68°08′ W., surface, in wood, August 29, 1885; *Albatross* Station 1655, Gulf Stream, surface).

DISTRIBUTION.—Cosmopolitan and widespread in tropical zones of the Indian, Pacific, and Atlantic Oceans. Carried by floating objects to North Atlantic (Gulf of Mexico, Florida, Bermuda, North Carolina, Massachusetts), South Atlantic (South Africa), North Pacific (China Sea, Japan), Indian Ocean (Ceylon). Intertidal to 112 fathoms; surface.

Genus *Pareurythoë* Gustafson, 1930

Type (designated by Hartman, 1959a): *Pareurythoë japonica* Gustafson, 1930. Contains only one New England species.

Pareurythoë borealis (Sars, 1862)

FIGURE 13*c*

Eurythoë borealis Fauvel, 1923, p. 129, fig. 46,*h–n*.
Pareurythoë borealis Okuda, 1938, p. 78, figs. 1–2.

DESCRIPTION.—Length up to 44 mm., width up to 3 mm., segments 23–77. Prostomium with convex quadrate area with median antenna and four eyes arranged in rectangle, the anterior pair larger; with semilunar buccal cushion anteriorly, bearing paired lateral antennae anterior to the eyes and paired palps laterally; the 5 prostomial appendages short, subulate, subequal. Prostomial caruncle extending from posterior part of prostomium on first 3 setigers, a simple, smooth, linear, smooth crest (fig. 13*c*). Ventral mouth surrounded by prostomial cushion and first 3 setigers. Anus terminal, with median oval lobe. Paired branchiae with few digitiform filaments (3–5), beginning on setiger 2 and continuing posteriorly. Dorsal and ventral cirri jointed basally. Notosetae capillary, harpoonlike, and bifurcated.

Neurosetae bifurcated, spinous. Color, in life: pale yellow to pale vermilion; red dorsal blood vessel.

BIOLOGY.—In parts of its range, found under stones, in tide pools in the shelly sand. Dredged on bottoms of shelly sand, sand and pebbles, mud and gravel. Rolls in a spiral when disturbed.

MATERIAL EXAMINED.—North Atlantic off Chesapeake Bay (*Albatross* Station 2265, 37°07′ N., 74°35′ W., 70 fathoms, mud and gravel, 1884; *Albatross* Station 2421, 37°07′ N., 74°34′ W., 64 fathoms, sand and pebbles, 1885).

DISTRIBUTION.—Norway, North Sea, English Channel, Mediterranean, North Atlantic off Chesapeake Bay, Japan. Low water to 70 fathoms.

Genus *Paramphinome* (M. Sars, MS.) G. O. Sars, 1872

Type (monotypy): *Paramphinome pulchella* (M. Sars, MS.) G. O. Sars, 1872. Contains only one New England species.

Paramphinome pulchella (M. Sars) G. O. Sars, 1872

FIGURE 13,*f*,*g*

Paramphinome pulchella G. O. Sars, 1872, p. 45, pl. 4, figs. 19–35.—McIntosh, 1900, p. 222, fig. 15.—Wesenberg-Lund, 1951, p. 23.—Eliason, 1962, p. 230.

DESCRIPTION.—Length up to 15 mm., width up to 1.5 mm., segments 24–42. Prostomium suboval, with a convex oval area with the median antenna in the center and extending posteriorly on the first segment (this posterior extension is considered to be a very primitive type of caruncle), with a semilunar buccal cushion anteriorly bearing the paired lateral antennae and palps; the 5 prostomial appendages are short, cylindrical, and subequal; without eyes. Ventral mouth surrounded by large rounded prostomial buccal cushion and first 2 setigers. Proboscis eversible, sac-like. Anus terminal, with median oval lobe.

Branchiae wide, fanlike, placed transversely, branched dicotymously 2-4 times, beginning on setiger 4 (or 3) and continuing on 4 to 12 segments, leaving the greater part of the body without branchiae. Dorsal cirri longer on first and last few setigers, others much shorter; ventral cirri longer on first setiger, rest short. Notopodia of first setiger each with a strong hook projecting forward. Rest of notosetae fine capillary and thornlike. Neurosetae fine, capillary, with or without short spurs; few are shorter, strongly serrated, with strong basal spur. Color in life: white, transparent.

BIOLOGY.—Dredged on bottoms of soft mud, silt, very fine to coarse sand and clay. Found in sponge (Florida) and in the stomach of haddock (Georges Bank, June 1954, R. Wigley). When irritated, rolls up in a ball, the long diverging notosetae sticking out in all directions, then straightens out slowly. Moves with a sluggish snakelike motion.

Material examined.—Maine (U.S. Fish Commission Station 66, Gulf of Maine, 65 fathoms, 1874; Station 16b, Jeffrey's Bank, 79 fathoms, 1873; *Bache* Station 3b, 8 miles south of Monhegan Island, 43°38′ N., 69°17′ W., 64 fathoms), Massachusetts (*Albatross* Station 2091, 40°01′ N., 70°59′ W., 117 fathoms; Georges Bank, 44–191 fathoms), Florida (Seahorse Key, September 1960, T. Hopkins).

Distribution.—Widely distributed along west coast of Norway and Sweden, Denmark, Iceland, Shetlands, Gulf of Maine to south of Long Island Sound, Gulf of Mexico (Florida). In 20 to 600 fathoms.

Family Euphrosinidae (=Euphrosynidae)

Body short, elliptical, with few segments (less than 40). Ventrum flat, dorsum more or less convex and bristly, formed by elongated, ridgelike, transverse setigerous notopodia with numerous spinelike notosetae nearly covering the dorsum. Prostomium (fig. 14,*a*,*b*) wedged between anterior segments, narrow, elongated, folded over anterior end, thus partly dorsal and partly ventral; dorsal part with 2 eyes lateral to median antenna, with a crestlike nuchal organ or caruncle extending posteriorly on some anterior segments and provided with longitudinal ciliated bands; ventral portion with 2 smaller eyes, two antennae lateral to eyes, a pair of large rounded, cushionlike palps just anterior to mouth; mouth surrounded by first 5 segments. Anal cirri a pair of short, oval, cushionlike lobes, surrounded by the posterior segments as seen ventrally (fig. 14*c*).

Parapodia (fig. 14*d*) biramous, with rami crestlike and indistinct, only slightly projecting. Notopodium a wide transverse ridge with 2 short digitiform dorsal cirri, one on inner side of lobe (inner dorsal cirrus) and the other about the middle of the lobe (outer dorsal cirrus); with numerous spinelike notosetae in several transverse rows, usually with several branchiae in a single transverse row posterior to the notosetae. Notosetae brittle, hollow, bifurcated, with one branch shorter than the other (may be in the form of a short lateral spur, fig. 14*e*). Neuropodium with unequally bifurcated neurosetae and a ventral cirrus posterior to the setae.

Includes creeping forms. When animal curls ventrally, setae stick out, giving the animal the appearance of a bur or a little porcupine. Proboscis elongated, cylindrical, unarmed.

Contains only one New England genus.

Genus *Euphrosine* (Savigny, MS.) Lamark, 1818

Type (designated by Hartman, 1959a): *Euphrosine myrtosa* (Savigny, MS.) Lamark, 1818.

All 3 species have the dorsal part of the prostomium with a ridgelike caruncle extending to segment 5 and consisting of 3 longitudinal parallel lobes, the middorsal one nearly covering the lateral ones; with a median antenna shorter than the caruncle, consisting of a thickened oval basal portion and a slender process about as long as the basal part (terminal filament may get knocked off), with a pair of eyes lateral to the base of the antenna (fig. 14*b*). Ventral part of prostomium with a pair of eyes closely approximated, a pair of very small antennae lateral to the eyes, with palps reduced to rounded cushions anterior and lateral to the ventral mouth (fig. 14*a*). Parapodia biramous, with rami slightly distinct. Setae transparent white to tan.

Key to the New England Species of *Euphrosine*

1. Notosetae of a single kind—all very unequally bifurcated, smooth, long, giving the dorsum a characteristic spiny aspect. Branchiae consisting of a single curled filament close to the upper dorsal cirrus (fig. 14*g*). **E. cirrata** (p. 63)

   Notosetae of 2 kinds: (1) Very unequally bifurcated, smooth; (2) unequally bifurcated, with branches longer, serrated on inner sides of branches (fig. 14*e*). Branchiae more numerous, branched, in a row posterior to the notosetae (fig. 14*d*) 2

2. Branchiae usually with 2–4 branches (1–12), without terminal clusters of branchlets (fig. 14*d*). Bifurcated serrated notosetae with longer branch curved toward shorter branch (fig. 14*e*). Notosetae much longer than branchiae, longest about same length as neurosetae, giving a shaggy appearance to dorsum . . . . **E. borealis** (p. 65)

   Branchiae with numerous branches, with terminal clusters of conical branchlets. Bifurcated serrated notosetae with branches diverging (fig. 14*f*). Notosetae only slightly longer than branchiae, shorter than neurosetae, giving a neat, trim appearance to dorsum . . . . **E. armadillo** (p. 65)

Euphrosine cirrata Sars, 1862

FIGURE 14*g*

Euphrosyne cirrata Fauvel, 1936a, p. 14.—Monro, 1939, p. 94.—Wesenberg-Lund, 1950a, p. 11, pl. 2, figs. 8, 9; 1953, p. 29.

DESCRIPTION.—Length up to 10 mm., width including setae up to 5 mm., segments about 20. Notopodium with a single curled filiform branchia close to the upper dorsal cirrus. About one-third of middorsum uncovered, without notosetae. Notosetae all very unequally bifurcated, long, slender, longer than neurosetae, arranged in 3 rows of longer to shorter spines, giving a characteristic spiny aspect.

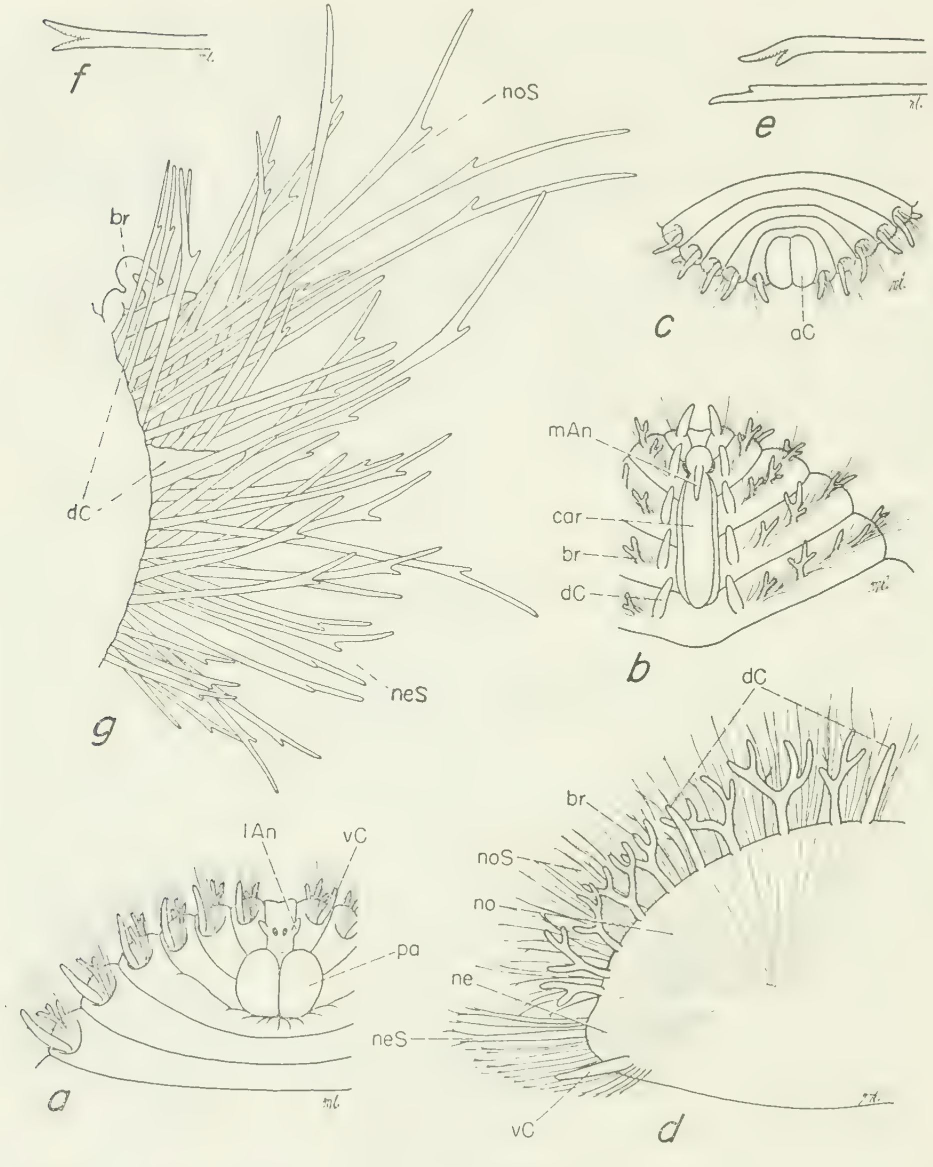

FIGURE 14.—Euphrosinidae, *a–e*, *Euphrosine borealis: a*, ventral view anterior end; *b*, dorsal view anterior end; *c*, ventral view posterior end; *d*, parapodium, posterior view; *e*, notosetae. *f*, *Euphrosine armadillo*, notoseta. *g*, *Euphrosine cirrata*, parapodium (after Wesenberg-Lund, 1950).

BIOLOGY.—Dredged on bottoms of gravel, pebbles, boulders, and ooze.

MATERIAL EXAMINED.—Nova Scotia (U.S. Fish Commission Location 70, about 120 miles south of Halifax, 190 fathoms, 1877; *Albatross* III, 42°09′ N., 65°59′ W., 118 fathoms, 1955, R. Wigley; *Delaware* Station, 42°11′ N., 65°30′ W., 66 fathoms, 1959, R. Wigley). Massachusetts (*Albatross* Station 2572, near Georges Bank, 40°29′ N., 66°04′ W., 1,769 fathoms, 1885). Off Chesapeake Bay (*Albatross* Station 2097, 37°56′ N., 70°57′ W., 1,917 fathoms, 1883).

DISTRIBUTION.—Greenland, Davis Strait, Norway, Iceland, Denmark Strait, Nova Scotia to off Chesapeake Bay, Antarctic. In 66 to 1,917 fathoms.

Euphrosine borealis Oersted 1843

FIGURE 14,*a–e*

Euphrosyne borealis Verrill, 1881, pp. 290, 303, 307, 314.—Webster and Benedict, 1887, p. 708.—Whiteaves, 1901, p. 88.—Treadwell, 1939a, p. 170, fig. 46,*a–b*.—Annenkova, 1937, p. 155; 1938, p. 139.—Wesenberg-Lund, 1953, p. 29.—Uschakov, 1955, p. 224, fig. 71.

Euphrosyne longisetis Treadwell, 1939a, p. 169, fig. 46,*g–i*.

DESCRIPTION.—Length up to 25 mm., width including setae up to 15 mm., segments 24–31. Dorsum nearly covered with notosetae, with only a narrow bare middorsal region without setae, the upper tips of the notosetae often overlapping middorsally. Each notopodium with usually 7 (6–8) branchiae, with 3 of them (rarely 2) between the inner and outer dorsal cirri. Branchiae dicotymously branched, usually 2–4 branches (1–12), the terminal filaments not knobbed or thickened. Notosetae of 2 kinds: (1) Longer spikelike smooth setae with short lateral spur, tapering to pointed or blunt tips (tips may be broken off), projecting far above the branchiae and giving a very hirsute aspect; (2) shorter unequally bifurcated serrated setae, the longer branch curved toward the shorter branch, with strongly marked serrations on inner sides. Neurosetae with tips somewhat hooked, with short lateral spur, about as long as longest notosetae. Colorless when preserved.

BIOLOGY.—Dredged on bottoms of mud, rocks, stones, sand and gravel, and gravel and stones.

MATERIAL EXAMINED.—Off Newfoundland, Gulf of St. Lawrence (Bay of Chaleurs), Nova Scotia, Gulf of Maine, Georges Bank, Massachusetts Bay, in 20 to 127 fathoms.

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Norway to Great Britain, Newfoundland, Gulf of St. Lawrence to Massachusetts (Massachusetts Bay), north Japan Sea. In 5 to 753 fathoms.

Euphrosine armadillo Sars, 1851

FIGURE 14*f*

Euphrosyne armadillo Fauvel, 1923, p. 137, fig. 49,*o-q*.—Wesenberg-Lund, 1950a, p. 12, pl. 2, figs. 10, 11; 1951, p. 24.

Euphrosyne branchiata Treadwell, 1939a, p. 170, fig. 46,*c-f*.

DESCRIPTION.—Length up to 10 mm., width including setae up to 4 mm., segments 19–21 (up to 30, Fauvel). About a third of middorsum bare, without setae. Each notopodium with 5–6 branchiae, with 2 of them between the inner and outer dorsal cirri; branchiae branched dicotymously several times, the tips with clusters of conical branchlets. Notosetae extending only slightly beyond the branchiae, shorter than the neurosetae, of 2 kinds: (1) Smooth pointed spines with much shorter lateral branch; (2) unequally bifurcated setae with branches arched, divergent, with strongly marked serrations on inner sides (fig. 14*f*). Neurosetae with curved hooked tips, with a strong lateral spur; some with an additional slender subterminal tooth. Colorless when preserved; brick red to pale yellowish in life.

Biology.—Dredged on bottoms of fine sand, shelly sand, sandy mud, sandy mud and corals, and mud and gravel. Some specimens were filled with large yolky eggs (October 18, 1894, 70 fathoms, off Chesapeake Bay).

Material examined.—Massachusetts (*Albatross* III, 40°31′ N., 67°19′ W., 79 fathoms, 1955, R. Wigley), off Chesapeake Bay (*Albatross* Station 2265, 37°07′ N., 74°35′ W., 70 fathoms, 1884; Station 2421, 37°07′ N., 74°34′ W., 64 fathoms, 1885).

Distribution.—Iceland, Norway, Faroes to France, off Massachusetts to off Chesapeake Bay. In 64 to 289 fathoms.

Family Spintheridae

A family represented by a single genus in which all known species are clinging forms, associated with or parasitic on sponges, which they tend to match in coloration. Body oval, convex dorsally, flattened ventrally, solelike, with ventral surface papillated or smooth. Parapodia biramous. Neuropodia cylindrical, each with 1 to several, strong yellow, compound, strongly hooked neurosetae. Notopodia forming elongated transverse ridges nearly covering the dorsum except for a narrow middorsal area, with more or less developed delicate lamellae supported by numerous spinelike notosetae in transverse rows, giving the animal the appearance of an oval pincushion.

Anterior parapodia directed anteriorly and fused medially, forming thus a continuous disc. Posterior parapodia smaller, directed posteriorly, radiating around the subterminal anus. Mouth ventral, surrounded by first few setigers. Proboscis unarmed, eversible, forming a voluminous rosettelike sac. Prostomium tiny, inconspicuous, posterior to the anterior fused parapodia, with a globular median antenna which nearly covers the prostomium, usually with 2 pairs of eyes at the base of the antenna. Without branchiae, dorsal or ventral cirri (in some species, the neuropodia have distal digitiform extensions which have been referred to as ventral or parapodial cirri).

Carnivorous or parasitic, living on sponges. Contains only one genus.

Genus *Spinther* Johnston, 1845

Type (monotypy): *Spinther oniscoides* Johnston, 1845. Contains only one New England species.

Spinther citrinus (Stimpson, 1854)

FIGURE 15

Spinther citrinus Verrill, 1881, pp. 290, 303, 307.—Webster and Benedict, 1887, p. 707.—Whiteaves, 1901, p. 87.—Treadwell, 1937, p. 25.—Wesenberg-Lund, 1950b, p. 41; 1951, p. 24.

Spinther oniscoides Annenkova, 1938, p. 139.—Hartman, 1942b, p. 35, figs. 45–46.—Treadwell, 1948, p. 10, fig. 1,*c–d*.—Uschakov, 1955, p. 107.—Not Johnston, 1845.

Spinther citrina Hartman, 1948, p. 16.

DESCRIPTION.—Length up to 28 mm., width up to 16 mm., segments 30–48. Ventral surface with numerous scattered globular papillae in midventral area and in lateral rows radiating to each neuropodium. Prostomium in clear area about the anterior fourth of dorsum, covered by an oval median antenna, at the base of which are 2 pairs of eyes. Transverse notopodial ridges nearly covering the dorsum, radiating anteriorly and posteriorly, with delicate lamellae, with numerous

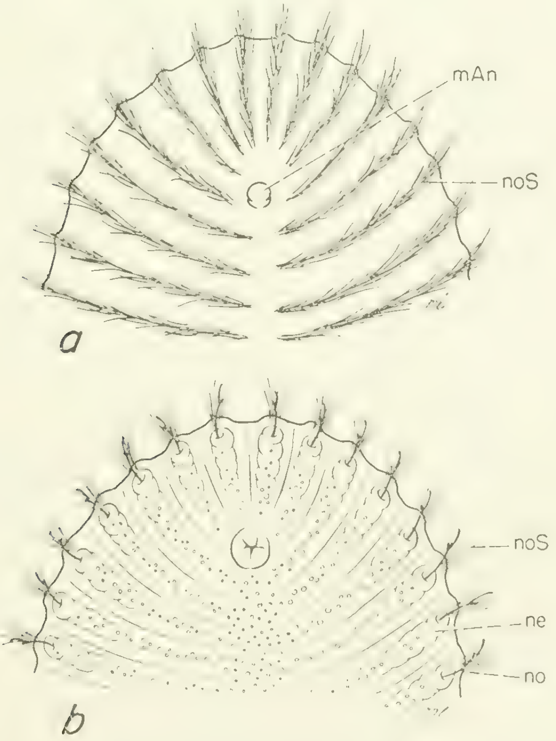

FIGURE 15.—Spintheridae, *Spinther citrinus*: *a*, dorsal view anterior end; *b*, ventral view anterior end.

notosetae in somewhat irregular double rows in each notopodium. Notosetae mostly spinelike, with entire pointed tips; few with terminal bifid tips; some more slender with tips entire or bifid. Neuropodia cylindrical, flexible, with a prominent digitiform parapodial extension posterior to the hooked neurosetae, referred to as a parapodial cirrus. Neuropodia each with usually a single, stout, compound, strongly hooked neuroseta; distal end of setal shaft diagonal, sometimes slightly crenulate on the inner hooked side. Color: lemon yellow, resembling the sponges with which they are found.

Biology.—Dredged on bottoms of gravel, rocks with mud and coral. They are associated with sponges, which they resemble in coloration. They are adapted to clinging tightly to the sponges.

Material examined.—Off Newfoundland, Gulf of St. Lawrence (south of Anticosti Island), Nova Scotia, Maine, New Hampshire, Massachusetts (off Cape Cod), in 23 to 120 fathoms.

Distribution.—West Greenland, Iceland, Faroes, Norway to English Channel, Canadian Arctic (Fox Basin) to Massachusetts (off Cape Cod), north Japan Sea. In 10 to 614 fathoms.

Family Phyllodocidae

Body usually elongated, vermiform, slender, with numerous segments. Prostomium well developed, subconical, suboval or cordiform, usually provided with 2 eyes (0–4), with 4 frontal antennae, with or without an odd median antenna, without palps. Anterior segments 1–3 modified, with 2–4 pairs of tentacular cirri. Parapodia uniramous (exceptionally subbiramous); setae compound (may be some additional simple setae), with terminal blades tapering to fine tips (compound spinigers, fig. 18*c*). Dorsal and ventral cirri flattened, enlarged, leaflike or more or less globular; dorsal cirri may be large, imbricated, more or less covering the dorsum (may resemble polynoids in this regard, fig. 17*b*). Two anal cirri. Proboscis eversible, powerful, with terminal papillae; surface smooth or with soft papillae; without jaws (may have some internal jaws in proboscis).

Carnivorous. Very active, moving about freely over surface and swimming; mucus secreted in quantities. Many lay their eggs in gelatinous masses, color of the eggs characteristically green. The larvae may have a long pelagic existence.

Key to the New England Genera of Phyllodocidae

1. Tentacular cirri 2 pairs, short, on first achaetous segment (fig. 16*a*). Prostomium subtriangular, widest basally, anterior part rounded, with four frontal antennae . . . . **Eteone (p. 69)**

   Tentacular cirri 3 pairs, on first 2 segments (fig. 17*c*). Prostomium suboval, with 4 frontal antennae, without nuchal tubercle . . . . **Mystides (p. 74)**

Tentacular cirri 4 pairs, on first 3 segments (first segment may be rudimentary or fused with second, not visible dorsally, figs. 17,*a*,*b*; 18*a*) 2

2. Prostomium with four frontal antennae, without median antenna 3

Prostomium with a median antenna in addition to four frontal antennae (figs. 17*b*, 19*a*). Prostomium suboval or subconical, without nuchal tubercle 4

3. First 2 segments fused, well developed, from which the first 3 pairs of tentacular cirri emerge (fig. 17*a*). Prostomium suboval, with or without nuchal tubercle . . . . **Paranaitis** (p. 75)

First segment rudimentary, not visible dorsally, with first pair tentacular cirri lateral to prostomium. Prostomium cordiform, with nuchal tubercle in posterior notch (may be withdrawn, fig. 18*a*). . . . **Phyllodoce** (p. 77)

4. With nuchal epaulettes (fig. 17*b*) . . . . **Notophyllum** (p. 83)

Without nuchal epaulettes 5

5. All 3 tentacular segments distinct dorsally (fig. 19*a*). Proboscis thickly papillated . . . . **Eulalia** (p. 84)

First tentacular segment rudimentary, not distinct dorsally, with first pair tentacular cirri lateral to prostomium (fig. 21*a*). Proboscis smooth, wrinkled or sparsely papillated . . . . **Eumida** (p. 88)

Genus *Eteone* Savigny, 1820

Type (monotypy): *Eteone flava* (Fabricius, 1780).

The species represented have the body linear elongate, slender, somewhat flattened dorsoventrally, with numerous segments (up to 100–400 or so), tapering gradually anteriorly and posteriorly. Prostomium (fig. 16*a*) trapezoidal to subtriangular, widest basally, tapering gradually anteriorly to a rounded area, with 4 subequal small frontal antennae, without a median antenna; with a small median nuchal tubercle (may be withdrawn and difficult to detect); with a pair of lateral nuchal slits (difficult to detect); and with a pair of deep set eyes on posterior part of prostomium (may not be visible when preserved and opaque).

First or tentacular segment achaetous, with 2 pairs of filiform tentacular cirri. Second segment without dorsal cirri, with or without setigerous lobes, with foliaceous ventral cirri. Ventral cirri elongate oval, about as long as setal lobe. Parapodia uniramous, slightly bifid distally; setae compound, with blades tapering to capillary tips. Proboscis with a circlet of soft papillae around opening, with surface smooth, rugose or irregularly papillate, with a pair of jaws inside proboscis (not visible unless dissected).

Characteristically burrowing forms.

Key to the New England Species of *Eteone*

1. Segment 2 with ventral cirri only, without setigerous lobe. Tentacular cirri unequal, ventral pair 2 to 3 times longer than dorsal pair (fig. 16*a*). Anal cirri subulate, tapering (fig. 16*b*) . . . . **E. lactea**

Segment 2 with setigerous lobe and setae well developed 2

2. Dorsal pair tentacular cirri twice as long as ventral pair, extending to segment 4 (fig. 16*g*). Anal cirri short, thick, elongate-oval . . . . . **E. trilineata**
   Two pairs tentacular cirri subequal or ventral pair slightly longer than dorsal pair 3
3. Middle and posterior dorsal cirri very asymmetrical, the outer side much longer than the inner side (fig. 16*d*). Anal cirri subulate, tapering. **E. heteropoda**
   Dorsal cirri symmetrical or only slightly asymmetrical. Anal cirri short, thick, almost spherical 4
4. Middle dorsal cirri longer than or as long as wide, nearly symmetrical, thick, flattened, bluntly conical, not much larger than parapodial lobe (fig. 16*e*). **E. longa**
   Middle dorsal cirri wider than long, somewhat asymmetrical, much larger than parapodial lobe (fig. 16*f*) . . . . **E. flava**

Eteone lactea Claparède, 1868

FIGURE 16,*a–c*

Eteone setosa Verrill and Smith, 1874, p. 294.
Eteone pusilla Verrill, 1881, pp. 304, 308.—Treadwell, 1948, p. 24, fig. 11*b*.—Miner, 1950, p. 316, pl. 102.—Not Oersted, 1843.
Eteone alba Webster and Benedict, 1884, p. 705—Webster, 1886, p. 134, pl. 5, figs. 13–16.—Hartman, 1945, p. 14, pl. 2, figs. 5–6; 1951, p. 33; 1959a, p. 145.—Pratt, 1951, p. 329.
Eteone lactea Fauvel, 1923, p. 175, fig. 63, *a–d*.—Clark, 1960, p. 17.

DESCRIPTION.—Length up to 230 mm., width up to 3 mm., segments up to 400. First few pairs dorsal cirri small, gradually get larger. Middle and posterior dorsal cirri much wider than long, asymmetrical, the outer side being longer than the inner side. Color in life: milky white, with or without flaky white specks, or pale yellow; color, preserved: white or tannish, sometimes with scattered light brownish spots which may be concentrated in three spots per segment or a short transverse band.

BIOLOGY.—Found intertidally near high water line, burrowing in firm mud, to low water in sandy shoals, sandy mud, and soft mud. Dredged in 2 to 100 fathoms on bottoms of sand, gravel, with broken shells, in mussel beds, among ascidians. Found at surface in evening in Woods Hole region (May 2, 1888).

MATERIAL EXAMINED.—Specimens from Gulf of St. Lawrence (Prince Edward Island), Nova Scotia (Lawrencetown, Halifax Co., September 20, 1957, R. Lane, J. McNeill), Maine (Cross River, Edgecomb), New Hampshire (Emerson's Beach, Oyster River), Massachusetts (Duxbury; Gloucester, Cape Ann; *Albatross* Station 2256, 40°38′ N., 69°29′ W., 30 fathoms, 1884; Woods Hole, surface in evening, May 2, 1881, V. N. Edwards; Woods Hole region: North Falmouth, Sippowisset, Stony Beach, Nobska, Lackeys Bay, Hadley Harbor, Cuttyhunk; Cape Cod Bay, Vineyard Sound, 17–23 fathoms),

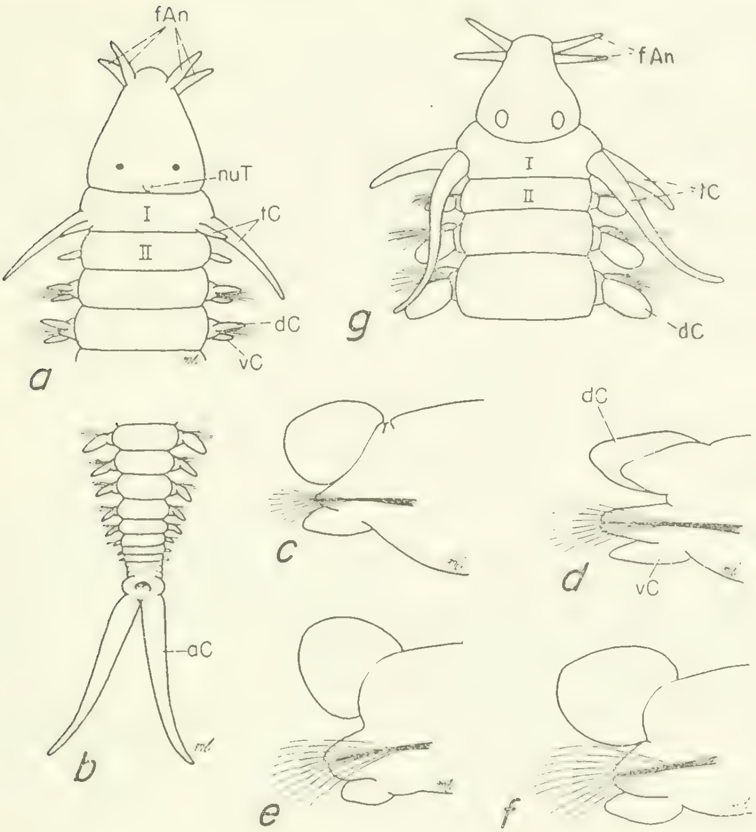

Figure 16.—Phyllodocidae, *a–c*, *Eteone lactea: a*, dorsal view anterior end; *b*, dorsal view posterior end; *c*, middle parapodium. *d*, *Eteone heteropoda*, middle parapodium. *e*, *Eteone longa*, middle parapodium. *f*, *Eteone flava*, middle parapodium. *g*, *Eteone trilineata*, dorsal view anterior end (after Webster and Benedict, 1887).

Rhode Island (off Newport), Connecticut (Noank Harbor), Long Island Sound, Virginia (Norfolk; off Chesapeake Bay, *Albatross* Station 2113, 35°20′ N., 75°19′ W., 15 fathoms, 1883). South Carolina (Charleston), Georgia (Sapelo Island, 10 fathoms).

Distribution.—Swedish west coast, Shetland Islands, Denmark, North Sea, the Baltic, Mediterranean, Gulf of St. Lawrence to Florida. Low water to 100 fathoms.

Eteone trilineata **Webster and Benedict, 1887**

Figure 16*g*

Eteone trilineata Webster and Benedict, 1887, p. 712, pl. 1, figs. 5–8, pl. 2, fig. 9.—Hartman, 1942c, p. 113, fig. 9,*f,g*.

Description.—Length up to 10 mm., width 1 mm., segments numerous. Dorsal cirri similar from anterior to posterior, about as wide as long, thick, broadly rounded, with attached margin concave. Color, in life: yellowish with narrow median and wide lateral longitudinal bands of dark brown; in alcohol: brownish with three darker longitudinal colored bands, faint middorsal and darker lateral ones.

BIOLOGY.—Found at low water and by shallow dredging on bottoms of sand, sandy mud with shells.

MATERIAL EXAMINED.—Type material from Eastport, Maine; also off Nova Scotia (*Albatross* Station 2065, 42°27′ N., 66°W., 80 fathoms, 1883), Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, 8–80 fathoms); off Massachusetts (*Albatross* III, 41°42′ N., 69°39′ W., 44 fathoms, August 21, 1957, R. Wigley).

DISTRIBUTION.—Gulf of St. Lawrence to off Massachusetts. In low water to 80 fathoms.

Eteone heteropoda Hartman, 1951

FIGURE 16*d*

Eteone heteropoda Hartman, 1951, p. 31, pl. 9, figs. 1–8.

DESCRIPTION.—Length up to 93 mm., width including setae up to 3 mm., segments up to 200. Anterior dorsal cirri subtriangular, nearly symmetrical; median and posterior dorsal cirri very asymmetrical, the outer side being longer than the inner side, elongate, conical, the attached margin exceedingly concave, enveloping the parapodial cirrophore which may be filled with coelomic contents including eggs or sperm masses. Color, in life: pale yellow or greenish, with dorsal and anal cirri darker; in alcohol: white or brownish.

BIOLOGY.—Found intertidally in sandy flats, mud and clay, and on bottoms of sandy mud of sloughs, estuaries and salt ponds of low salinity. Dredged on bottoms of mud and shells. Some specimens were massed with eggs in December (Mississippi, 1943). Small specimens were found on the bottom (as few as 13 segments; Chesapeake Bay, March 1921).

MATERIAL EXAMINED.—Maine (Woodbridge Island, Sheepscot River), Massachusetts (Plum Island, Squam River, Gloucester, U.S. Fish Commission, 1878; Barnstable Harbor, 1959, H. Sanders), Rhode Island (Newport; Greenhill Pond, north cove; Charlestown Pond, night tide plankton sample, November and December 1954, H. P. Jeffries; Greenwich Bay, A. P. Stickney), New Jersey (Raritan Bay, D. Dean), Maryland (Chesapeake Bay, Broom's Island, about 10 miles from mouth of Patuxent River; *Fish Hawk* Station 8804, 7 fathoms, 1920; Station 8961, 10 fathoms, 1921; Station 8963, 5 fathoms, 1921), Florida (Seahorse Key, 1960, J. Taylor).

DISTRIBUTION.—Maine to Chesapeake Bay, Gulf of Mexico (Florida to Texas). In low water to 10 fathoms.

Eteone longa (Fabricius, 1780)

FIGURE 16*e*

Eteone cinerea Webster and Benedict, 1884, p. 705, pl. 1, figs. 1–5.—Miner, 1950, p. 316, pl. 102.

Eteone robusta Verrill and Smith, 1874, p. 294.—Sumner, Osburn, and Cole, 1913, p. 616.—Hartman, 1942b, p. 39, figs. 52–56.—Procter, 1933, p. 138, fig. 31.

Eteone longa Fauvel, 1923, p. 172, fig. 62,*a–d*; 1933, p. 16.—Thorson, 1946, p. 59, fig. 26.—Wesenberg-Lund, 1953, p. 32.—Pettibone, 1954, p. 234, fig. 27*h*.—Uschakov, 1955, p. 101, fig. 8.—Rasmussen, 1956, p. 34, figs. 10–12.—Clark, 1960, p. 17.

Eteone arctica Treadwell, 1948, p. 24, fig. 11*d*.

Eteone arctica var. *robertiana* Berkeley and Berkeley, 1954, p. 459.

DESCRIPTION.—Length up to 160 mm., width up to 5 mm., segments up to 200. Dorsal cirri small, not much larger than the parapodial lobe, longer than wide or as long as wide, nearly symmetrical, thick, flattened, bluntly conical. Color, in life: white to light gray with scattered brown specks, pale or dark green; color, preserved: yellowish, reddish or greenish brown, iridescent, with darker colored dorsal cirri, may have dark blue iridescence with deep velvety blue dorsal cirri.

BIOLOGY.—Found at low water in mud flats, muddy sand, sand, gravel, under stones, in eelgrass. May be found rather high intertidally. Dredged on bottoms of sandy mud, sand and shells, and various combinations of soft mud, sand, gravel, pebbles, rocks, shells, and worm tubes. Numerous specimens were present at one station in the oceanographic fouling studies (from Cape Cod Bay). Some specimens were filled with yolky eggs in April (Rye Harbor and Hampton Harbor, New Hampshire, 1954). According to Thorson (1946, p. 59), the eggs are spawned in irregular slimy lumps; the larvae have a relatively short planktonic existence. Rasmussen (1956) observed the early developmental stages in Denmark; adults may be found swimming actively near the surface; spawning occurs in April and May.

MATERIAL EXAMINED.—Gulf of St. Lawrence (St. Lawrence estuary, Gaspé Bay, Bay of Chaleurs, Anticosti Island, Madeleine Islands, low water to 60 fathoms), Newfoundland, Nova Scotia, New Brunswick (St. Andrews), Maine (Machias Bay, Rockland, Boothbay Harbor region, Bay of Fundy, Sea Point near Kittery; *Albatross* III, 41°32′ N., 65°57′ W., 1954, R. Wigley), New Hampshire (Rye Harbor, Hampton Harbor near entrance to Blackwater River, Newcastle, Hilton Park on Dover Point), Massachusetts (Massachusetts Bay, Cape Cod Bay, low water to 55 fathoms), off Chesapeake Bay (*Albatross* Station 2111, 35°09′ N., 74°57′ W., 938 fathoms, 1883).

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Norway to English Channel, Hudson Bay to off North Carolina, Bering Sea to Mexico, north Japan Sea, China. In low water to 938 fathoms.

Eteone flava (Fabricius, 1780)

FIGURE 16*f*

Eteone depressa Verrill, 1881, pp. 304, 308, 311.
Eteone sarsi Webster and Benedict, 1887, p. 711.
Eteone flava Fauvel, 1923, p. 173, fig. 62,*e–f*.—Wesenberg-Lund, 1953, p. 33.—Pettibone, 1954, p. 235, fig. 27*g*.—Uschakov, 1955, p. 101, fig. 8.—Clark, 1960, p. 17.

DESCRIPTION.—Length up to 120 mm., width up to 4 mm., segments numerous. Dorsal cirri wider than long, slightly asymmetrical, much larger than parapodial lobe. Color, in life: grayish white, pinkish, pale yellow or brick red; color, preserved: brownish with bluish-violet iridescence.

BIOLOGY.—Found intertidally among rocks and gravelly sand. Dredged on bottoms of mud and various combinations of mud, gravel, and rocks and shells.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Saguenay River, Laurentian Channel, 28 fathoms), New Brunswick (north of North Point, St. Andrews), Maine (Gulf of Maine, U.S. Fish Commission Location 66, 65 fathoms, 1874).

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Faroes, Norway to English Channel, Gulf of St. Lawrence to Maine, Bering Sea, north Japan Sea. Low water to 471 fathoms.

Genus *Mystides* Théel, 1879

Type (monotypy): *Mystides borealis* Théel, 1879. Contains only one New England species.

Mystides borealis Théel, 1879

FIGURE 17*c*

Mystides viridis Webster and Benedict, 1887, p. 712, pl. 1, figs. 10–11, 13, pl. 2, fig. 12.
Mystides borealis Fauvel, 1923, p. 181, fig. 65,*a–d*.—Pettibone, 1954, p. 232, fig. 27*b*.

DESCRIPTION.—Length up to 16 mm., width up to 0.8 mm., segments up to 75. Body small, linear, tapering anteriorly and posteriorly, flattened dorsoventrally. Prostomium suboval, with 2 deep-set eyes and 4 filiform frontal antennae. Tentacular cirri 3 pairs, a pair on first segment and 2 pairs on second segment; cirri enlarged basally, tapering to long filiform tips. Dorsal, ventral, and anal cirri oval, thick, flattened. Color, in life: yellowish brown, greenish yellow or light green with darker cirri; color preserved:

without color or irregularly pigmented with brown, cirri deep reddish brown.

BIOLOGY.—Dredged on bottoms of stones and rocks, sand, muddy sand with shells, stones with barnacles, sand dollars.

MATERIAL EXAMINED.—Type of *M. viridis* from Eastport, Maine, Gulf of St. Lawrence (Gaspé Bay, 5 fathoms).

DISTRIBUTION.—Scattered records in the Arctic and Antarctic. Also Ireland, Madeira, Mediterranean, Gulf of St. Lawrence to Maine, west coast North America (Washington). In 4 to 214 fathoms.

Genus *Paranaitis* Southern, 1914

Anaitis Malmgren, 1865, preoccupied by Duponchel (1829, Lepidoptera); type (monotypy): *Anaitis wahlbergi* Malmgren, 1865.

Both species have the prostomium suboval, with a more or less distinct posterior extension, with 4 frontal antennae, 2 large eyes (fig. 17*a*). First 2 segments fused dorsally, prolonged anteriorly and embracing the sides of the prostomium, with 3 pairs tentacular cirri. Fourth pair tentacular cirri on segment 3 (first setigerous). Tentacular cirri stouter basally, tapering to slender tips. Upper 2 pairs longer, extending to setiger 4. Lower 2 pairs shorter. Dorsal cirri large, overlapping neatly. Ventral cirri elongate ovate, posterior to lower half of parapodial lobe. Parapodial lobe cylindrical, bilabiate distally, with long slender compound setae. Anal cirri oblong oval.

Key to the New England Species of *Paranaitis*

1.	Dorsal cirri broadly ovate, asymmetrical, lateral sides longer than medial sides	**P. speciosa**
	Dorsal cirri subreniform, nearly symmetrical (fig. 17*d*) . . .	**P. kosteriensis**

***Paranaitis speciosa* (Webster, 1880)**

FIGURE 17*a*

Anaitis speciosa Webster and Benedict, 1884, p. 702; 1887, p. 710.—Webster, 1886, p. 131, pl. 4, figs. 8–9.

Anaitis formosa Verrill, 1885b, p. 433.—Hartman, 1944a, p. 337, pl. 23, fig. 8.

Anaitis picta Verrill, 1885b, p. 433.—Hartman, 1944a, p. 338, pl. 14, fig. 1.

Paranaitis speciosa Treadwell, *in* Cowles, 1930, p. 341 (part; mixed with *Eteone heteropoda*).

DESCRIPTION.—Length up to 18 mm., width up to 3 mm., segments up to 55. Body widest in middle, tapering gradually posteriorly and more so anteriorly, slightly convex dorsally, flattened ventrally. Prostomium without nuchal papilla. Proboscis narrow, cylindrical, papillated. Color, in life: somewhat variable, iridescent, greenish yellow with reddish spots middorsally and laterally at the bases of the dorsal cirri and the parapodia, with coalesced transverse reddish

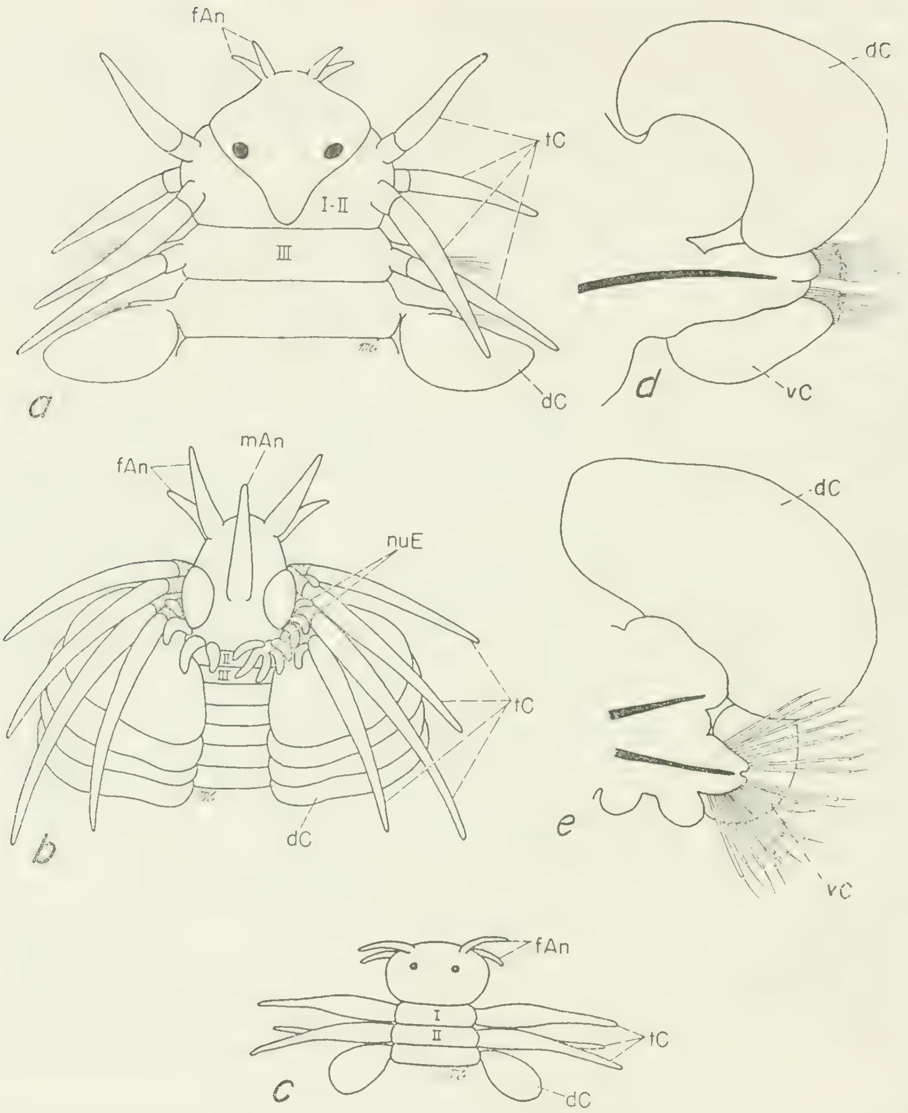

Figure 17.—Phyllodocidae, *a*, *Paranaitis speciosa*, dorsal view anterior end. *b*, *Notophyllum americanum*, dorsal view anterior end (drawn from Type specimen). *c*, *Mystides borealis*, dorsal view anterior end. *d*, *Paranaitis kosteriensis*, parapodium (after Bergström, 1914). *e*, *Notophyllum foliosum*, left parapodium from segment 45 (after Bergström, 1914).

band on segments 9 and 10 (setigers 7 and 8); dorsal cirri greenish with a brownish spot on the outer half and small yellowish dots on inner half; dorsum may be pale or dark green with brown pigmented spots and wide band. Color, preserved: yellowish brown with yellowish green cirri (the darker band on setigers 7 and 8 may or may not be retained).

Biology.—Found at low water in sand, in beds of *Mytilus edulis*, on tubes of *Diopatra cuprea*. Dredged in shallow waters on bottoms of sand, clay, mud and shells. Appear in surface waters (Vineyard Sound, August 1881). Specimen found in a very thick mucous sheath (Cape Cod Bay, 17 fathoms).

Material examined.—Maine (*Albatross* III, 41° 54′ N., 68° 18′ W., 100 fathoms, 1955, R. Wigley), Massachusetts (Vineyard Sound, 27 fathoms; Wellfleet, Cape Cod; Cape Cod Bay, 17 fathoms), Rhode Island (U.S. Fish Commission Location 815, off Block Island Light, 29 fathoms, 1880), New Jersey (Raritan Bay), Maryland (Chesapeake Bay, *Fish Hawk* Station 8898, 15 fathoms, 1920; Station 8966, 10 fathoms, 1921), Florida (Seahorse Key, 1960, J. Taylor).

Distribution.—Maine to Chesapeake Bay. Low water to 100 fathoms.

Paranaitis kosteriensis (Malmgren, 1867)

Figure 17*d*

Phyllodoce (*Anaitis*) *kosteriensis* Fauvel, 1923, p. 157, fig. 56,*a–c*.—Clark, 1960, p. 16.

Paranaitis kosteriensis Pettibone, 1956a, p. 554.—Eliason, 1962, p. 234.

Description.—Length up to 85 mm., width up to 4 mm., segments up to 155. Body rather slender, flattened dorsoventrally, slightly attenuated anteriorly and posteriorly. Prostomium with a nuchal papilla (may be retracted). Without color or irregularly streaked deep purpilsh (in alcohol).

Biology.—Dredged on bottoms of mud, mud and sand.

Material examined.—North Atlantic (*Albatross* Station 2084, 40°16′ N., 67°05′W., 1,290 fathoms, 1883; Station 2231, 38°29′ N., to off 73° 09′ W., 965 fathoms, 1884).

Distribution.—Sweden, Denmark, Scotland, Ireland, Labrador to off Delaware. In 6 to 1,290 fathoms.

Genus *Phyllodoce* (Savigny, MS.) Lamarck, 1818

Type (monotypy): *Phyllodoce laminosa* (Savigny, ms.) Lamarck, 1818.

Subgenus *Anaitides* Czerniavsky, 1882

Type (designated by Bergström, 1914, p. 77): *Anaitides groenlandica* (Oersted, 1842).

All four species have the body elongate, linear, with numerous segments, attentuated posteriorly. Prostomium (fig. 18*a*) cordiform, notched posteriorly with a nuchal tubercle in the notch (may be withdrawn) rounded anteriorly, slightly indented at the level of the 4 short subequal frontal antennae, with 2 eyes, with a pair of nuchal papillae just anterior to the first pair of tentacular cirri (may be extended or withdrawn).

First tentacular segment not visible dorsally; first pair tentacular cirri lateral to prostomium. Second segment with 2 pairs tentacular cirri, without setae. Third segment with fourth pair tentacular cirri, setigerous lobes and ventral cirri. Tentacular cirri unequal, 2 longer pairs extending to segments 8–12. Dorsal cirri of median region subquadrangular, with distal ends truncate, extending upward over dorsum (fig. 18,*b*,*d*,*e*). Except for some anterior segments, with a transverse band of long cilia in the middle of each segment and extending onto inner posterior sides of dorsal cirri. Parapodia uniramous, slightly bilobed distally; compound setae with blades tapering to capillary tips (fig. 18*c*). Pair of anal cirri, cylindrical, tapering. Anterior part of extended proboscis hexagonal, transversely rugose, crowned with papillae; basal part with oval papillae arranged in longitudinal rows (in *P. arenae*, so crowded, difficult to detect rows).

Key to the New England Species of *Phyllodoce* (*Anaitides*)

1. Ventral cirri oval, not pointed (fig. 18*d*). Body with brownish spots middorsally, with diffused brownish longitudinal bands dorsolaterally; dorsal cirri spotted . . . . **P. (A.) maculata**
   Ventral cirri oval with asymmetrical acuminate tip (fig. 18*e*). Body rather uniformly pigmented greenish, grayish brown, or bluish. **P. (A.) groenlandica**
   Ventral cirri pointed (fig. 18*b*) 2
2. Middorsum with brown spots, sometimes forming an almost continuous longitudinal band. Basal part of proboscis with 6 longitudinal rows of papillae on each side (fig. 18*f*) . . . . **P. (A.) mucosa**
   Dorsum with wide spindle-shaped dark transverse brown bands (fig. 18*a*). Basal part of proboscis covered with papillae except for narrow middorsal part . . . . **P. (A.) arenae**

Phyllodoce (*Anaitides*) *maculata* (Linné, 1767)

FIGURE 18*d*

Phyllodoce maculata Agassiz, 1867, p. 303, figs. 46–55.—Fauvel, 1923, p. 152, fig. 53,*a–c*.—Procter, 1933, p. 137.—Annenkova, 1938, p. 141.—Thorson, 1946, p. 54, fig. 22.—Baillie, 1946, p. 474.—Berkeley and Berkeley, 1948, p. 46, fig. 67.—Wesenberg-Lund, 1950b, p. 34; 1951, p. 27.—Smidt, 1951, p. 47, fig. 15.—Newell, 1954, p. 333.—Uschakov, 1955, p. 91, fig. 3.—Fauvel and Rullier, 1959, p. 510.—Clark, 1960, p. 15.

Phyllodoce gracilis Verrill and Smith, 1874, p. 292, pl. 11, fig. 56.

Phyllodoce catenula Verrill, 1881, pp. 300, 304, 307, 311, pl. 5, fig. 4 (part).—Whiteaves, 1901, p. 82.—Sumner, Osburn, and Cole, 1913, p. 616.—Procter, 1933, p. 137.—Miner, 1950, p. 314, pl. 102.—Pratt, 1951, p. 329.

Phyllodoce badia Webster and Benedict, 1887, p. 710 (in USNM).—? Procter, 1933, p. 137.

Anaitides gracilis Hartman, 1942b, p. 38, figs. 50–51.

Anaitides catenula Hartman, 1944a, p. 338, pl. 34, fig. 1.—Treadwell, 1948, p. 27.

Anaitides maculata Treadwell, 1948, p. 27, fig. 14*a*.

Description.—Length up to 100 mm., width up to 2 mm., segments up to 250. Basal part of proboscis with 12 longitudinal rows of oval compressed papillae (6 on each side), with 6–8 papillae per row. Color, in life: yellowish or greenish with brownish spots on middorsal part of each segment and more diffused brownish pigment dorsolat-

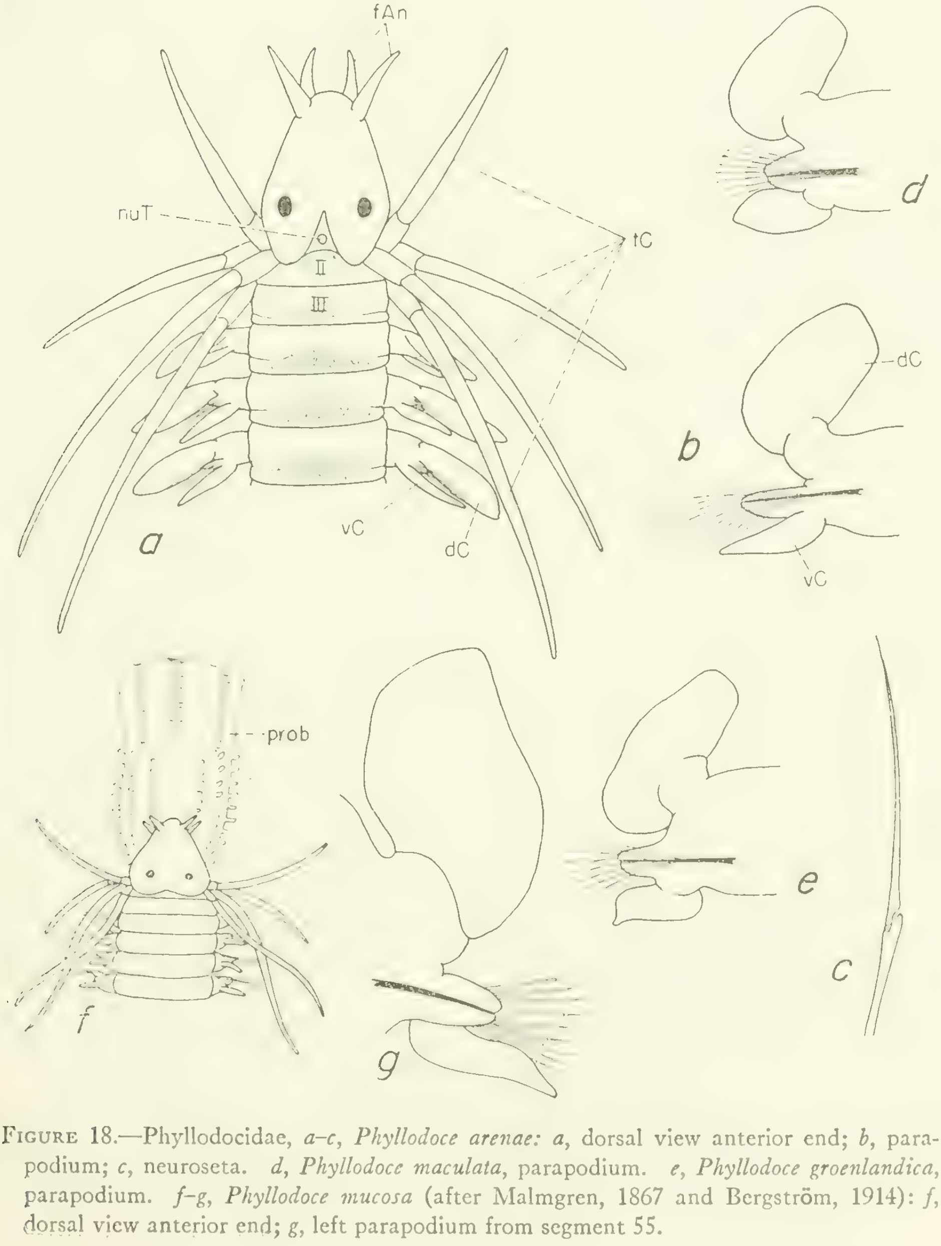

Figure 18.—Phyllodocidae, *a–c*, *Phyllodoce arenae*: *a*, dorsal view anterior end; *b*, parapodium; *c*, neuroseta. *d*, *Phyllodoce maculata*, parapodium. *e*, *Phyllodoce groenlandica*, parapodium. *f–g*, *Phyllodoce mucosa* (after Malmgren, 1867 and Bergström, 1914): *f*, dorsal view anterior end; *g*, left parapodium from segment 55.

erally; dorsal cirri green or brown; color, preserved: tannish to greenish with brown spots; may be nearly continuous dorsolateral longitudinal bands and middorsal spots in intersegmental areas.

BIOLOGY.—Found intertidally in rocky pools, on algae, hydroids, in muddy sand under rocks, on pilings among mussels, hydroids, and algae (as *Laminaria*) and encrusting calcareous algae. Dredged on bottoms of mud, rocks, shells, coarse sand, gravel and shells, with sponges, "weed," algae, among bryozoan nodules, tunicates (as sandy *Amaroecium*). They were extremely numerous among the fouling organisms in the oceanographic fouling studies in the New England area; they evidently feed on barnacles as they were found in large gregarious clumps among and inside the valves of the barnacles, the barnacle flesh being in all stages of breakdown. It is an active species, secreting a great deal of mucus. It is predaceous, attacking and devouring other polychaetes and nemerteans, being itself protected to some extent by its abundant offensive mucus. They were found in the stomach of the flatfish *Limanda ferruginea* Storer (Bay of Chaleurs, June 19, 1956), and of haddock (Georges Bank, 1953 and 1954, R. Wigley).

According to Thorson (1946, p. 54) and Smidt (1951, p. 47), it lays transparent gelatinous egg masses with green eggs, the masses anchored to the bottom with long branched prolongations. Spawning takes place in February to May. The larvae hatch a few days later and have a long planktonic existence. The early developmental stages were followed by Agassiz (1867). According to Newell (1954) their green jelly cocoons are attached to stones and weeds during the several weeks breeding period in April to May at Whitstable. According to Moore (MS.), in the Woods Hole area it is gregarious during the breeding period, breeding in April and again in July; at this time the secretion of mucus appears to be especially abundant.

MATERIAL EXAMINED.—Numerous specimens from Gulf of St. Lawrence, off Newfoundland, Nova Scotia, New Brunswick, Maine, New Hampshire, Massachusetts, Rhode Island, Long Island Sound, low water to 90 fathoms.

DISTRIBUTION.—West Greenland, Iceland, Norway to North Sea, France, West Africa, Hudson Bay to Rhode Island, Alaska to British Columbia, north Japan Sea. In low water to 90 fathoms.

Phyllodoce (Anaitides) groenlandica Oersted, 1842

FIGURE 18*e*

Phyllodoce groenlandica Verrill, 1881, pp. 289, 294, 295, 304, 308, 314, 315, 316, pl. 5, fig. 5.—Webster and Benedict, 1884, p. 703; 1887, p. 710.—Whiteaves, 1901, p. 82.—Fauvel, 1923, p. 153, fig. 54, *f–i*.—Procter, 1933, p. 137.—Thorson, 1946, p. 52, fig. 21.—Miner, 1950, p. 312, pl. 102.—Pratt, 1951, p.

329.—Pettibone, 1954, p. 237, fig. 27, *d,i;* 1956a, p. 553.—Uschakov, 1955, p. 90, figs. 2–3.—Stickney, 1959, p. 15.—Clark, 1960, p. 16.—Berkeley and Berkeley, 1961, p. 657.

Anaitides groenlandica Treadwell, 1948, p. 27, fig. 14*b*.—Eliason, 1962, p. 230.

Description.—Length up to 450 mm., width up to 9 mm., segments up to 700. Basal part of proboscis with 12 longitudinal rows of papillae (6 rows on each side) with 10–20 papillae per row. Color, in life: deeply pigmented bright metallic green with irregular brown markings, dark greenish brown or deep reddish blue, with cirri tan to dark brown; color, preserved: deeply pigmented, iridescent reddish blue with cirri reddish brown, or tannish with middorsal longitudinal iridescent bluish band, dorsal cirri greenish brown.

Biology.—Found at low water in sand, in holdfasts of algae, on pilings. Dredged on bottoms of mud, sand, sandy mud, and various combinations of mud, gravel, stones, with shells, worm tubes, algae, etc. Found in the stomach of the cod *Gadus callarias* (Miscou Bank, Gulf of St. Lawrence, July 30, 1952, May 27, 1953, June 25, 1954), in the plaice *Hippoglossoides platessoides* (Bay of Chaleurs, July 27, 1957), and in the stomach of haddock (Georges Bank, 1953 and 1954, R. Wigley). According to Thorson (1946), they lay oval, olive-green, gelatinous egg masses which adhere by short stalks to algae; larvae hatch as large trochophores and have a long pelagic life; larvae occur mainly in March to September.

Material examined.—Off Labrador, Gulf of St. Lawrence, Nova Scotia, and Newfoundland to off North Carolina, in low water to 866 fathoms.

Distribution.—Widely distributed in the Arctic. Also Iceland, Norway to English Channel, Hudson Bay to North Carolina, Bering Sea to southern California, north Japan Sea. In low water to 866 fathoms.

Phyllodoce (Anaitides) mucosa **Oersted, 1843**

Figure 18, *f, g*

Phyllodoce mucosa Webster and Benedict, 1887, p. 710.—Fauvel, 1923, p. 152, fig. 54,*a–e*.—Procter, 1933, p. 137.—Støp-Bowitz, 1948a, p. 16.—Chapman and Dales, 1954, p. 680.—Pettibone, 1956a, p. 553.—Banse, 1959, p. 422.—Clark, 1960, p. 15.

Description.—Length up to 150 mm., width up to 3 mm., segments up to 200. Basal part of proboscis with 12 longitudinal rows of papillae (6 on each side), with 8–12 papillae per row. Color, in life: white with middorsal longitudinal brown band (almost continuous); also may have dark pigment laterally at the bases of the parapodia (thus 3 longitudinal pigmented bands); dorsal cirri with large brown spot in center; may have additional paired yellow spots near the bases of the parapodia.

Biology.—Found at low water in muddy sand and sand mixed with gravel, on pilings. Dredged on bottoms of mud, sand, sandy mud, and mud with rocks, worm tubes and shells. Specimens massed with green eggs in April (New Hampshire, low water, April 8, 1954) and July (Massachusetts Bay off Plymouth, 17 fathoms, July 25, 1953).

Material examined.—Off Labrador, Gulf of St. Lawrence, Newfoundland, Nova Scotia, Maine, New Hampshire, Massachusetts, Connecticut, Long Island Sound, Gulf of Mexico, in low water to 146 fathoms.

Distribution.—Scattered records in the Arctic. Also Iceland, Danish and Swedish coasts to France, Mediterranean, Azores, Hudson Bay to Long Island Sound, Gulf of Mexico, Alaska to southern California and Mexico, west coast Africa. In low water to 245 fathoms.

Phyllodoce (Anaitides) arenae Webster, 1879

Figure 18,*a–c*

Phyllodoce catenula Verrill and Smith, 1874, p. 293, (part; not description or figure, but Woods Hole, at surface, evening, July 3).

Phyllodoce arenae Webster and Benedict, 1884, p. 703.—Webster, 1886, p. 133, pl. 5, figs. 10–12.

Anaitides catenula Hartman, 1942c, p. 109, fig. 8,*b–e*.—Not Verrill, 1873a.

Description.—Length up to 100 mm., width up to 2.5 mm., segments up to 200. Basal portion of proboscis covered with crowded conical papillae, except for narrow bare middorsal area. Color, in life: body white or green with wide spindle-shaped transverse band near the intersegmental region, with central brown spot midventrally in each segment, with dorsal cirri with diffused brown pigment at its base and an additional brown spot on the outer central part; color, preserved: transversely banded, dorsal cirri spotted.

In the original description of *P. catenula* Verrill, 1873, the localities given included: (1) Watch Hill, Rhode Island, 4–6 fathoms, rocks, algae, tide pools; (2) Woods Hole, at surface, evening, July 3 (in USNM); (3) also very common in Bay of Fundy, low water to 50 fathoms. Two species are evidently included. The description and figures of *P. catenula* and evidently localities (1) and (3) are referable to *P. maculata* (Linné); the specimens from locality (2) were not used in the original description or figures by Verrill and are the same as *P. arenae*.

Biology.—Found at low water in beaches of sand and muddy sand with rubble. Found swarming at the surface in June, July, and August (Eel Pond, Woods Hole, August 6, 1944, D. P. Costello; Fisheries Dock, Woods Hole, evening, July 26, 1951, June 8, and 11, 1954, M. Pettibone; Vineyard Sound, evening, July 3, 1871, A. E. Verrill). Active species, giving off a great deal of mucus when handled. Dredged on bottoms of sand, gravel and shells.

Material examined.—Maine (U.S. Fish Commission Station 360, 42°03′ N., 69°22′ W., 106 fathoms, 1879), Massachusetts (Georges Bank, 19 66 fathoms; Cape Cod, Provincetown, Wellfleet Harbor, Orleans, Barnstable; Woods Hole region, Nantucket Sound, West Falmouth Harbor, Stony Beach, Nobska, Eel Pond, Woods Hole Harbor).

Distribution.—Off Maine to New Jersey. Low water to 106 fathoms; swarms at surface.

Genus *Notophyllum* Oersted, 1843

Type (designated by Bergström, 1914, p. 76): *Notophyllum viride* Oersted, 1843; =*N. foliosum* (M. Sars, 1835).

Both species have the body linear, slightly attenuated anteriorly and posteriorly, convex dorsally, flattened ventrally. Prostomium suboval, with 2 large eyes with lenses, with 4 short thick frontal antennae and a longer median antenna between the eyes. A pair of ciliated nuchal epaulettes posterior to prostomium, more or less lobulated (fig. 17*b*). Tentacular cirri 4 pairs on 3 segments, 1 pair lateral to prostomium (first segment reduced dorsally), 2 pairs on segment 2, fourth pair on segment 3 above the first normal ventral cirrus. Dorsal cirri large, about twice as wide as long, platelike, subreniform in shape, imbricated (superficially resembling polynoids). Ventral cirri large, oval, posterior to neuropodia. Parapodia subbiramous, notopodia represented by small acicular lobe with internal aciculum on lateral sides of cirrophores of dorsal cirri; with or without few simple capillary setae (fig. 17*e*). Neuropodia with fanshaped group of compound setae; blades tapered to capillary tips.

Key to the New England Species of *Notophyllum*

1. Paired nuchal epaulettes simple or bilobed. Dorsal cirri cover middorsum. **N. foliosum**

Each of paired nuchal epaulettes consisting of 4–7 or so lobes (fig. 17*b*). Dorsal cirri leave narrow strip of middorsum uncovered. **N. americanum**

Notophyllum foliosum (Sars, 1835)

Figure 17*e*

Notophyllum foliosum Fauvel, 1923, p. 170, fig. 16,*a–e*; 1933, p. 16.—Hartman, 1948, p. 18, fig. 3,*d–f*.—Wesenberg-Lund, 1950a, p. 10, pl. 1, fig. 4.—Uschakov, 1955, p. 95.—Banse, 1959, p. 426.—Uschakov and Wu, 1959, p. 24.—Clark, 1960, p. 17.

Description.—Length up to 55 mm., width up to 4 mm., segments up to 115. Color, in life: greenish grey with green cirri bordered with brown; in alcohol: brownish or greenish.

Biology.—Dredged on bottoms of mud, gravel, rocks with large barnacles.

MATERIAL EXAMINED.—Maryland (off Chesapeake Bay, *Albatross* Station 2011, 36° 38′ N., 74° 40′ W., 81 fathoms, 1883; Station 2265, 37° 07′ N., 74° 35′ W., 70 fathoms, 1884), Washington (between Point Evans and Fosdick, Puget Sound, 20–22 fathoms; Rosario Strait near Pevine Pass, Washington Sound).

DISTRIBUTION.—Norway to Spain, Mediterranean, Adriatic, east coast North America (off Chesapeake Bay), Alaska to Washington, north Japan Sea to Japan, Yellow Sea, Manchuria. In 16 to 936 fathoms.

Notophyllum americanum Verrill, 1885a

FIGURE 17*b*

Notophyllum americanum Verrill, 1885a, pl. 40, fig. 184; 1885b, p. 432.—Hartman, 1944a, p. 338, pl. 23, fig. 7.

DESCRIPTION.—Length up to 50 mm., width 5 mm., segments about 125. Color, in life: very dark green; preserved: brownish with bluish iridescence with dark brown cirri.

MATERIAL EXAMINED.—Type specimen from off Martha's Vineyard, Massachusetts, 100 fathoms.

DISTRIBUTION.—Known only from the original record, off Massachusetts (Martha's Vineyard). In 100 fathoms.

Genus *Eulalia* Savigny, 1820

Hypoeulalia Bergström, 1914; type (original designation): *Hypoeulalia bilineata* (Johnston, 1840).

Type (designated by Bergström, 1914, p. 76): *Eulalia viridis* (Linné, 1767).

Both species have the body elongate, slender, linear, convex dorsally, flattened ventrally, attenuated at both ends. Prostomium suboval, slightly constricted just posterior to origin of four subequal frontal antennae, with 2 eyes of moderate size close to posterior margin (fig. 19*a*). All 3 tentacular segments visible dorsally. Tentacular cirri 4 pairs, cylindrical, fusiform, upper 2 pairs longer. Parapodia uniramous, slightly bilabiate distally; neurosetae compound. Dorsal cirri longer than wide. Proboscis long, cylindrical, with surface densely covered with rounded to cylindrical papillae (fig. 19*a*).

Key to the New England Species of *Eulalia*

1. Dorsal cirri elongate-lanceolate, pointed distally (fig. 19*b*). Prostomium with median antenna subequal to frontal antennae (fig. 19*a*). Greenish . . . . **E. viridis**

Dorsal cirri thick, short, oval-obtuse, rounded distally (fig. 20*b*). Prostomium with median antenna very small and slender, smaller than frontal antennae (fig. 20*a*). Usually greenish with lateral longitudinal dark bands. . . . . **E. bilineata**

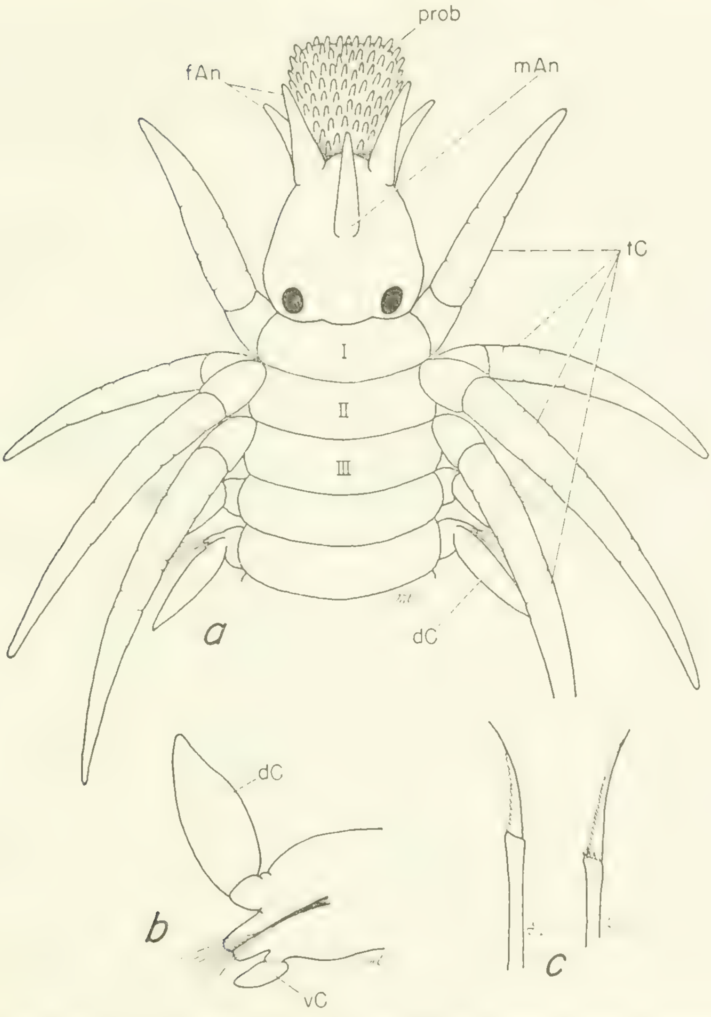

FIGURE 19.—Phyllodocidae, *Eulalia viridis: a*, dorsal view anterior end, proboscis partially extended; *b*, parapodium; *c*, neurosetae.

Eulalia viridis (Linné, 1767)

FIGURE 19

Eulalia annulata Verrill and Smith, 1874, p. 291 (type in USNM).—Sumner, Osburn, and Cole, 1913, p. 616.—Procter, 1933, p. 138.

Eumidia papillosa Verrill and Smith, 1874, p. 290 (type in USNM).

Eulalia pistacia Verrill, 1881, pp. 300, 304, 308, pl. 5, fig. 6 (part; types in USNM; =mixture of *Eulalia viridis* and *Eumida sanguinea*).—Sumner, Osburn, and Cole, 1913, p. 617.—Miner, 1950, p. 314, pl. 102.—Pratt, 1951, p. 329.

Eulalia dubia Webster and Benedict, 1884, p. 704, pl. 8, figs. 101–105; 1887, p. 711 (types in USNM).—Miner, 1950, p. 314, pl. 102.

Eulalia quadrioculata Moore, 1906a, p. 220, pl. 10, figs. 4–6 (type in USNM).—Hartman and Reish, 1950, p. 11.

Eulalia viridis Fauvel, 1923, p. 160, fig. 57,*a–e*; 1933, p. 15; 1953, p. 122, fig. 61,*a–h*.—Monro, 1933b, p. 19.—Annenkova, 1937, p. 157; 1938, p. 142.—

Okuda, 1938, p. 88.—Hartman, 1942b, p. 37; 1944a, p. 338, pl. 23, fig. 11; 1948, p. 20, fig. 5*a*.—Thorson, 1946, p. 58, fig. 25.—Baillie, 1946, p. 473.—Berkeley and Berkeley, 1948, p. 48.—Treadwell, 1948, p. 26, fig. 13*a*.—Wesenberg-Lund, 1950b, p. 35; 1951, p. 28.—Uschakov, 1955, p. 98, fig. 5.—Banse, 1959, p. 423.—Uschakov and Wu, 1959, p. 25.—Fauvel and Rullier, 1959, p. 511.—Clark, 1960, p. 16.

DESCRIPTION.—Length up to 150 mm., width up to 3 mm., segments up to 200. Prostomium with 2 moderately large eyes; sometimes with scattered pigment lateral to the eyes. Second tentacular segment with 2 pairs tentacular cirri, with setae. Longest tentacular cirri extend to setigers 10–12. Color, in life: pale to dark green including dorsal cirri, with or without brown spots on dorsal cirri and on bases of parapodia both dorsally and ventrally; dorsum also may be somewhat spotted; eggs green; color, preserved: pale to deep green, bluish gray, yellowish to golden brown, iridescent.

BIOLOGY.—Found intertidally in rocky tide pools, in gravelly sand, peat, on pilings and wharfs among ascidians, sponges, mussels, algae (as *Laminaria*) and encrusting calcareous algae. Dredged on bottoms of sand, mud, rocks, gravel, stones, with shells, large barnacles, sponges, algae, "weed," bryozoan nodules, compound tunicates, being especially abundant among sandy tunicates *Amaroecium pellucidum* (in Woods Hole area). One of the more abundant organisms found in the oceanographic fouling studies in the New England area. Eggs laid in slimy green egg masses on sandy spots among rocks or on algae and sponges (Thorson, 1946). Males massed with white sperm masses and females with green eggs found in July (Rye Harbor, New Hampshire, July 3, 1958).

MATERIAL EXAMINED.—Numerous specimens from North Atlantic (off Newfoundland, Gulf of St. Lawrence, Nova Scotia, Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, Long Island Sound, low water to 64 fathoms), North Pacific (Washington and Puget Sound, Strait of Juan de Fuca, low water to 22 fathoms).

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Scandinavian countries to English Channel, Mediterranean, West Africa, Gulf of St. Lawrence to New Jersey, Alaska to Oregon, Panama, Japan, China, Indian Ocean. In low water to 125 fathoms.

***Eulalia bilineata* (Johnston, 1840)**

FIGURE 20

Eulalia gracilis Verrill and Smith, 1874, p. 292 (type in USNM).—Webster and Benedict, 1884, p. 703.—Sumner, Osburn, and Cole, 1913, p. 617.

Eulalia bilineata Webster and Benedict, 1887, p. 710, pl. 1, figs. 1–3, pl. 2, fig. 4 (type in USNM; same as *E. bilineata* Johnston, 1840).

Eulalia bilineata Fauvel, 1923, p. 162, fig. 58,*a–c*.—Annenkova, 1937, p. 157; 1938, p. 143.—Berkeley and Berkeley, 1948, p. 48, fig. 71.—Wesenberg-Lund, 1953, p. 32.—Uschakov, 1955, p. 98, fig. 5.—Uschakov and Wu, 1959, p. 25.

Hypoeulalia bilineata Procter, 1933, p. 138.—Hartman, 1942*b*, p. 35; 1944a, p. 338, pl. 23, fig. 9; 1959a, p. 154.—Hartman and Reish, 1950, p. 12.
Eulalia problema Baillie, 1946, p. 472.—Treadwell, 1948, p. 26, fig. 13*c*.
Eulalia (*Hypoeulalia*) *bilineata* Day, 1960, p. 300, fig. 5,*d–f*.

DESCRIPTION.—Length up to 100 mm., width up to 2 mm., segments up to 150. Second tentacular segment with setae. Longest tentacular cirri extend to setiger 5. In addition to the compound neurosetae, there may be long, delicate capillary setae extending far beyond the other setae; capillary setae mixed in with the other setae but not in separate bundles as in some of the Syllidae; evidently an epitokous condition associated with sexual forms. Color, in life: variable in coloration, gray, yellow greenish or olive brown, usually with lateral brown bands on each side and darker spots at bases of parapodia, both above and below; preserved: brownish iridescent, sometimes showing darker longitudinal bands, dorsal cirri dark velvety brown, almost black.

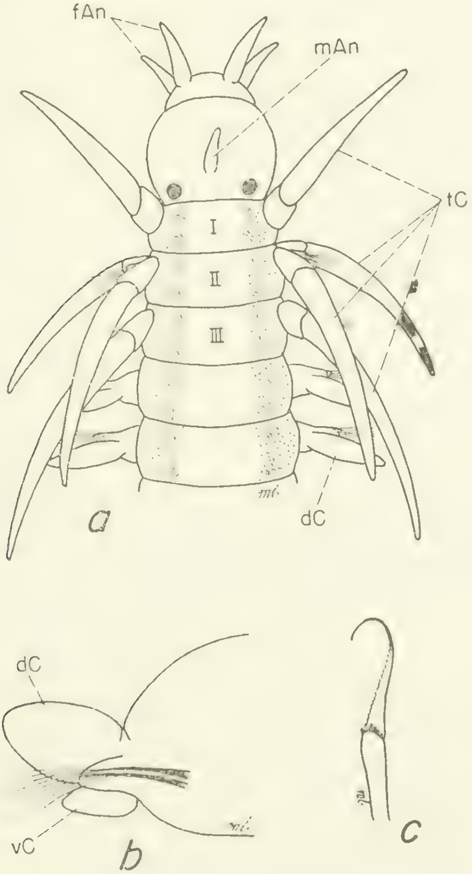

FIGURE 20.—Phyllodocidae, *Eulalia bilineata*: *a*, dorsal view anterior end; *b*, parapodium; *c*, n uroseta.

BIOLOGY.—Found intertidally among rocks, in encrusting calcareous algae, in holdfasts of *Laminaria*. Dredged on bottoms of mud, fine grey sand, rocks, and various combinations of sand, gravel, rocks, with shells, bryozoan nodules, ascidians, hydroids. Sexually mature in May to July in British waters (McIntosh, 1908).

MATERIAL EXAMINED.—North Atlantic (Gulf of St. Lawrence, Nova Scotia, Maine, Massachusetts, Rhode Island, Long Island Sound, North Carolina, low water to 1,290 fathoms), North Pacific (Puget Sound, Washington, 30–60 fathoms).

DISTRIBUTION.—Scattered records in the Arctic. Also Scandinavian countries to British Isles, the Baltic, Gulf of St. Lawrence to North Carolina, Vancouver Island to central California, north Japan Sea, Yellow Sea, South Africa. Low water to 1,290 fathoms.

Genus *Eumida* Malmgren, 1865

Type (monotypy): *Eumida sanguinea* (Oersted, 1843).

Both species have the body rather thickly set, relatively short and wide, tapering anteriorly and posteriorly, arched dorsally, flattened ventrally. Prostomium cordiform, rounded anteriorly, slightly notched posteriorly, with 2 eyes (fig. 21*a*). First tentacular segment not visible dorsally, the first pair of tentacular cirri lateral to prostomium; second tentacular segment with 2 pairs tentacular cirri; third segment with fourth pair tentacular cirri, setigerous lobes and ventral cirri. Neuropodia thick, bilobed distally; neurosetae compound, with long tapering terminal blades.

Key to the New England Species of *Eumida*

1. Neuropodia bilobed distally with lobes subequal, rounded (fig. 21*b*). Median antenna in middle of prostomium, more slender than frontal antennae. **E. sanguinea**

   Neuropodia bilobed distally with supra-acicular lobe longer, pointed; subacicular lobe shorter, rounded (fig. 21*c*). Median antenna posterior on prostomium, subequal in size to frontal antennae . . . . . **E. fusigera**

Eumida sanguinea (Oersted, 1843)

FIGURE 21,*a*, *b*

Eumidia americana Verrill and Smith, 1874, p. 290.—Sumner, Osburn, and Cole, 1913, p. 617.

Eumidia vivida Verrill and Smith, 1874, p. 290 (part; type in USNM; =mixture of *E. sanguinea* and *Eulalia viridis*).

Eumida maculosa Webster, 1879, p. 215, pl. 4, figs. 38–41; 1886, p. 134.—Webster and Benedict, 1884, p. 703.

Eulalia longicornuta Moore, 1906a, p. 222, pl. 10, figs. 7–8 (type in USNM).

Eumida tubiformis Moore, 1909b, p. 342, pl. 16, figs. 22–23 (type in USNM).

Eulalia (Eumida) sanguinea Fauvel, 1923, p. 166, fig. 59,*f–k;* 1953, p. 125, fig. 63,*f–k;* 1955, p. 6.—Annenkova, 1937, p. 158; 1938, p. 143.—Thorson,

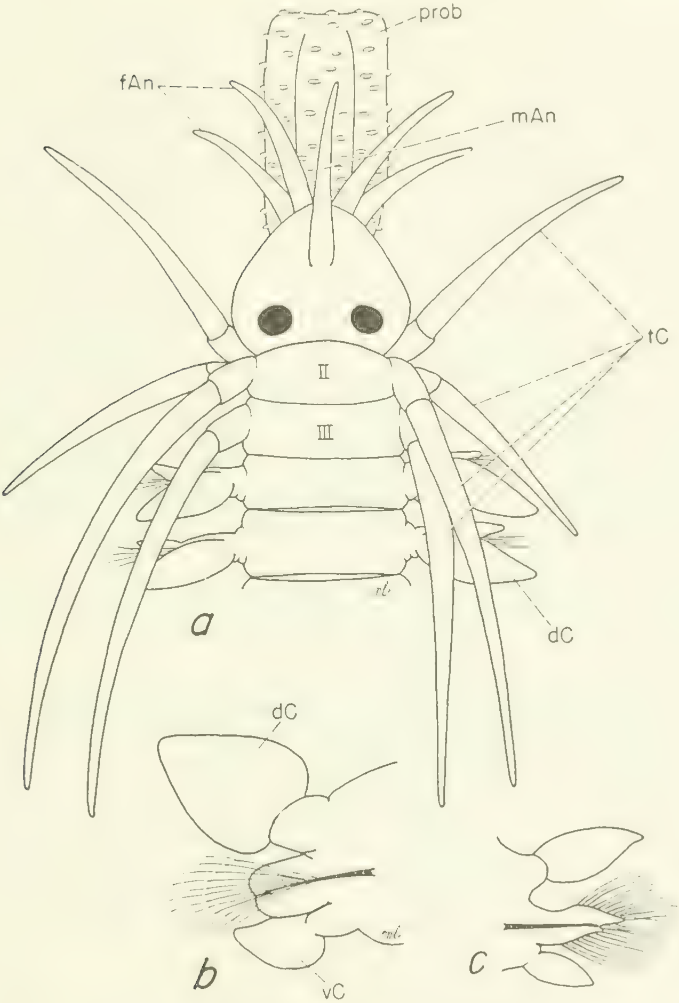

FIGURE 21.—Phyllodocidae, *a–b*, *Eumida sanguinea:* *a*, dorsal view anterior end, proboscis partially extended; *b*, parapodium. *c*, *Eumida fusigera*, parapodium (after Malmgren, 1865).

1946, p. 56, fig. 24.—Berkeley and Berkeley, 1948, p. 47, fig. 69.—Wesenberg-Lund, 1949, p. 273.—Day, 1953, p. 411; 1960, p. 301.—Uschakov, 1955, p. 98, fig. 6.—Uschakov and Wu, 1959, p. 25.—Clark, 1960, p. 16.—Knox, 1960a, p. 113.

Eumida sanguinea Hartman, 1942b, p. 36; 1942c, p. 112, fig. 8,*f–g;* 1944a, p. 338, pl. 23, fig. 10; 1945, p. 14; 1951, p. 34.—Baillie, 1946, p. 473.—Treadwell, 1948, p. 25, fig. 12*b*.—Hartman and Reish, 1950, p. 11.—Wesenberg-Lund, 1951, p. 29.—Rioja, 1958, p. 228.—Reish, 1959, p. 78.—Eliason, 1962, p. 232.

DESCRIPTION.—Length up to 60 mm., width up to 4 mm., segments up to 140. Tentacular cirri 4 pairs, cylindrical, upper 2 pairs longer, extending to setigers 8–9. Dorsal cirri thin, anterior ones rather small, lanceolate; middle ones become broader, cordiform, pointed (fig. 21*b*); posterior ones more elongated, pointed. Ventral cirri thin, oval, lanceolate, about length of setigerous lobe. Anal cirri wider basally, tapered abruptly to slender tips. Extended proboscis cylindrical, with a circle of papillae around opening, smooth or with somewhat indefinite scattered papillae (fig. 21*a*). Color, in life: extremely variable, pale, tannish, yellowish to brown including dorsal cirri, dusky, dotted or transversely banded with green or brown, eggs green; preserved: greyish green, tannish to reddish brown, may be somewhat spotted or transversely banded, dorsal cirri somewhat spotted.

Biology.—Found intertidally, on shells, under rocks, on pilings along with tunicates, sponges, in roots of sea basket grass. Dredged on bottoms of mud, gravel, stones, rocks, with shells, algae, bryozoan nodules and especially abundant with sandy tunicates *Amaroecium pellucidum*. Numerous small specimens and females massed with green eggs were found during the summer months in the Woods Hole region. According to Thorson (1946, p. 56), they spawn in May to July.

Material examined.—Numerous specimens from North Atlantic (Gulf of St. Lawrence, Maine, Massachusetts, Rhode Island, Connecticut, Virginia, North Carolina, low water to 146 fathoms), Georgia (Sapelo Island, 10 fathoms), North Pacific (Washington and Puget Sounds, low water to 60 fathoms).

Distribution.—Iceland, Norway to France, Mediterranean, Adriatic, Gulf of St. Lawrence to Georgia, Gulf of Mexico (Florida), Venezuela, Queen Charlotte Islands and Vancouver Island to Lower California, Mexico, Galápagos Islands, north Japan Sea to Japan, Persian Gulf, Black Sea, Red Sea, Indian Ocean, New Zealand, South Africa. In low water to 339 fathoms.

Eumida fusigera (Malmgren, 1865)

Figure 21*c*

Sige fusigera Malmgren, 1865, p. 100, pl. 14, fig. 27.
Eumida fusigera Levinsen, 1882, p. 205.
Eulalia fusigera Banse, 1959, p. 425.

Description.—Length up to 30 mm., width without setae 4 mm., segments numerous. Tentacular cirri 4 pairs, first pair short, cylindrical; second and fourth pairs (upper ones) long, extend to about setiger 12; third lower pair shorter, flattened basally. Dorsal cirri elongate-lanceolate, little longer than the parapodial lobe. Ventral cirri elongate-pointed, about length of parapodial lobe. Proboscis smooth, without papillae.

Biology.—Dredged on bottoms of mud and sand.

Material examined.—North Atlantic (*Albatross* Station 2262, 39°54′ N., 69°29′ W., 250 fathoms, 1884).

Distribution.—Norway, Sweden, off Massachusetts. In 250 fathoms.

Family Alciopidae

Exclusively pelagic (may be considered as pelagic phyllodocids derived from the *Eulalia* stock). Body transparent, rather short to considerably elongated, cylindrical, with regularly arranged pigmented glands, which may be associated with pigmented bands (fig. 22*a*) or pigmented lobes at the bases of the parapodia (fig. 23*b*). Fragile, fragmenting easily.

Prostomium small, with 4 frontal antennae and a median antenna (may be rudimentary), flanked by 2 enormous, spherical, highly organized, orange or red eyes with globular lenses, directed laterally. The prominent lateral position and the extreme development of the eyes result in very extensive vision, forward, outward, and backward. Tentacular cirri 3–5 pairs. Parapodia elongated, uniramous, with foliaceous dorsal and ventral cirri. Setae numerous, long, capillary, transparent, all simple or all compound or both types. Predatory. Proboscis unarmed (rarely with horny denticles), encircled with papillae around opening (two lateral papillae may be of considerable size).

Many alciopids have evolved a copulatory mechanism whereby the males agglutinate the sperm into a kind of spermatophore and transfer them to the females where they may be stored in modified parapodia or sperm receptacles until required (fig. 22*a*). Mostly oceanic in surface waters where they are sparsely distributed in the plankton. The 2 species included here are merely representatives of the family.

Key to the Genera of Alciopidae

1. Parapodia terminating in single cirriform appendage (fig. 22,*c*,*d*) . . **Vanadis**
   Parapodia terminating in 2 cirriform appendages (fig. 23*b*) . . . . . **Alciopa**

Genus *Vanadis* Claparède, 1870

Type (monotypy): *Vanadis formosa* Claparède, 1870.

Vanadis longissima (Levinsen, 1885)

FIGURE 22

Vanadis longissima Fauvel, 1923, p. 207, fig. 77,*f*,*g*.—Monro, 1930, p. 79, fig. 24.—Støp-Bowitz, 1948a, p. 29.—Dales, 1955, p. 439; 1957, p. 121, figs. 31–33.—Tebble, 1960, p. 187.

DESCRIPTION.—Length up to 200 mm., width up to 3 mm., segments up to 200. Body long, thin, cylindrical, delicate, fragmenting readily, transparent, with bright red eyes and dark brown glands forming characteristic segmentally arranged bands. Prostomium small, with 2 pairs of subequal frontal antennae and a short conical median antenna between the 2 enormous spherical eyes. Tentacular cirri

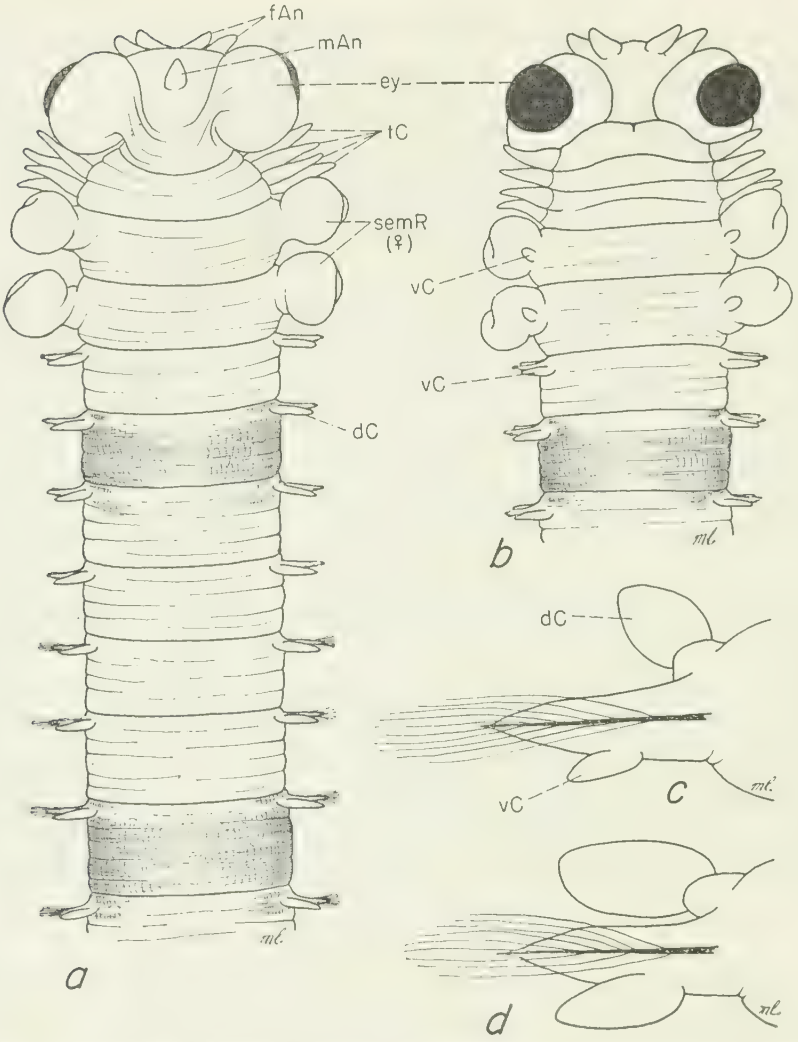

Figure 22.—Alciopidae, *Vanadis longissima: a,* dorsal view anterior end of female; *b,* same, ventral view; *c,* anterior parapodium; d, parapodium from middle region.

4 pairs, the first pair larger and united ventrally by an incised membrane. First 6–8 segments with parapodia rudimentary, without setae. In female, dorsal cirri of first 2 pairs of rudimentary parapodia modified into large globular sperm receptacles (fig. 22,*a*,*b*).

Parapodial lobes longer than cirri, cylindrical, tapering to a single short cirriform appendage, from which aciculum projects. Setae long, compound, fine, transparent. Dorsal cirri elongate-ovate, ventral cirri narrower and elongated. Pigmented segmental glands found on 1 or 2 successive segments followed by 4–9 segments which lack them; glands rather small, accompanied by dark brown rings of pigment which form almost a complete circle. Proboscis cylindrical, with 10 small toothlike subequal papillae.

Material examined.—*Grampus* (*Bache*) 1914, Station 10161, off Cape Hatteras, North Carolina, 35°23′ N., 73°14′ W., 100–0 meters, January 28; Station 10166, off South Carolina, 32°33′ N., 72°14′ W., 100–0 meters, January 30; Station 10180, off Bermuda, 31°52′ N., 65°14′ W., 75–0 meters, February 18.

Distribution.—Cosmopolitan, Atlantic, Pacific, Indian Ocean, Antarctic. In surface waters.

Genus *Alciopa* (Audouin and Milne-Edwards, MS.), Cuvier, 1830

Halodora Greeff, 1876; type (original designation): *Halodora reynaudii* (Audouin and Milne-Edwards).

Greeffia McIntosh, 1885; type (monotypy): *Greeffia oahuensis* McIntosh, 1885; =*Alciopa reynaudii* (Audouin and Milne-Edwards, ms.), Cuvier, 1830.

Type (monotypy): *Alciopa reynaudii* (Audouin and Milne-Edwards, ms.), Cuvier, 1830.

Alciopa reynaudii (Audouin and Milne-Edwards, MS.), Cuvier, 1830

Figure 23

Greeffia oahuensis Monro, 1930, p. 82, fig. 25.—Wesenberg-Lund, 1939, p. 35, fig. 23.

Alciopa reynaudii Audouin and Milne-Edwards, 1833b, p. 238, pl. 15, figs. 6–11.—Støp-Bowitz, 1948a, p. 30, fig. 21.—Dales, 1957, p. 124, figs 34, 35.—Tebble, 1960, p. 193.

Greefia oahuensis Berkeley and Berkeley, 1958, p. 400.

Description.—Length up to 50 mm., width up to 8 mm., segments up to 60. Body relatively short, tapering slightly anteriorly and considerably posteriorly. Prostomium extends slightly beyond the 2 very large globular lateral eyes, with 2 pairs short subulate frontal antennae and a median antenna in the dorsal groove between the eyes. Tentacular cirri 3 pairs, short, subulate. Parapodia terminating distally in 2 small cirriform appendages. Setae compound. Both dorsal and ventral cirri massive, foliaceous, ovate cordiform, somewhat frilled, imbricated, covering the parapodia almost completely. With prominent projecting brown glands, segmentally arranged dorsally and ventrally at the bases of the parapodia. Proboscis with 2 long lateral papillae (usually project conspicuously from the mouth; fig. 23*a*).

Material examined.—*Grampus* (*Bache*) 1914, Station 10195, north of Bahamas (29° N., 76°23′ W., 100–1 meters, February 28), Station 10200, Straits of Florida (23°32′ N., 81°48′ W., 75–0 meters, March 18).

Distribution.—Cosmopolitan, North and South Atlantic, Indian Ocean, tropical Pacific, Antarctic. In surface waters.

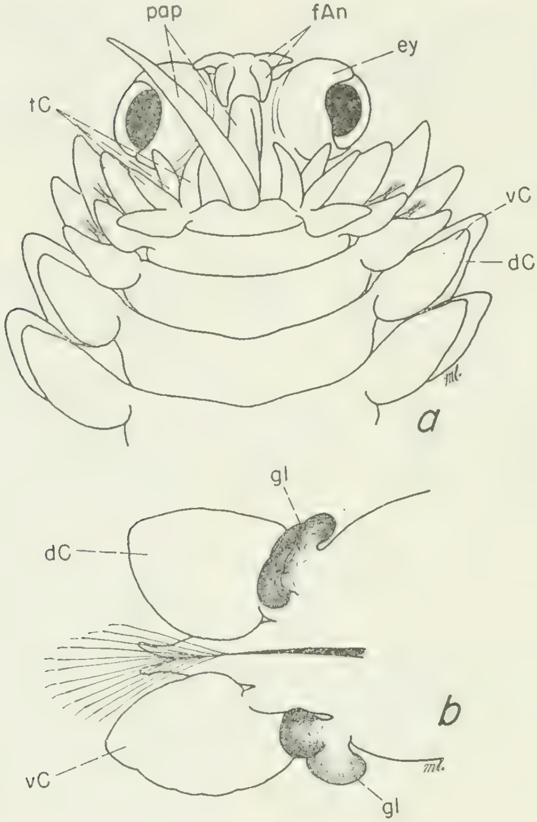

Figure 23.—Alciopidae, *Alciopa reynaudii: a*, ventral view anterior end with 2 large papillae of proboscis projecting from mouth; *b*, parapodium, posterior view.

Family Tomopteridae

Exclusively pelagic. Body colorless, transparent, crystal clear, segments few, without distinct segmental lines or septa. Setae lacking except for a single internal seta in each of one to two pairs of anterior modified tentacular cirri. Prostomium and tentacular segments fused to form a head region provided with a pair of diverging flattened anterior antennae, a short pair of tentacular cirri (may be small, inconspicuous or lacking, fig. 25*a*), a large pair of tentacular cirri which may be longer than the body, a pair of ciliated epaulettes or nuchal organs near the bases of the tentacular cirri, 2 deep-set eyes close to the oval cerebral ganglion (visible due to the transparency of the body).

Parapodia of trunk region longer than the body is wide, without setae or acicula, distally bilobed, each ramus bordered with a flattened finlike membrane or pinnule bearing glands of various kinds, referred to as rosette organs (yellow or brown spheres with a darker center; with fatty globules blackened by osmic acid; thought to be luminescent organs), chromophile glands (colorless, stain with nuclear stains as hematoxylin), and hyaline glands (not stained by hematoxylin; usually colored by a reddish-brown secretion). Proboscis eversible, short, unarmed; when everted, has the shape of an elliptical disk.

Voracious predators in the plankton. Some species may at times be the dominant forms of the plankton and must be of considerable importance as food for fishes. Swim with great swiftness by the rapid vibrations of the lateral finlike parapodia, darting through the water in all directions.

Contains only one New England genus.

Genus *Tomopteris* Eschscholtz, 1825

Type (monotypy): *Tomopteris onisciformis* Eschscholtz, 1825.

Both species have the long setigerous tentacular cirri originating from broad subconical bases, extending from one half to almost the length of the body (fig. 24). Parapodial rami conical, entirely bordered by oval membranous plates or pinnules (fig. 25,*b–c*).

Key to the New England Species of *Tomopteris*

1. With a tail region (fig. 24; absent in young). Rosette organs present (fig. 25*b*). With first pair short tentacular cirri present in young (fig. 25*a*), absent in adult (fig. 24). With gonads in both dorsal and ventral rami of parapodia . . . . **T. helgolandica**

   Without a tail region. Rosette organs absent. Without first tentacular cirri in young or adult. With gonads in dorsal rami of parapodia only (fig. 25*c*). . . . . **T. septentrionalis**

Tomopteris helgolandica Greeff, 1879

FIGURES 24, 25,*a*,*b*

Tomopteris smithii Verrill, 1879, p. 182.—Hartman, 1944a, p. 338, pl. 25, figs. 8, 9.

Tomopteris (*Johnstonella*) *helgolandica* Moore, 1903b, p. 798, pl. 55, fig. 13.—Southern, 1911, p. 8.—Sumner, Osburn, and Cole, 1913, p. 624.—Fauvel, 1923, p. 221, fig. 83,*h*,*i*; 1953, p. 143, fig. 71,*h*,*i*.—Støp-Bowitz, 1948a, p. 42, fig. 28.—Clark, 1960, p. 17.—Eliason, 1962, p. 238.

Tomopteris (*Johnstonella*) *catharina* Huntsman, 1921, p. 86, figs. 1, 2.—Bigelow, 1928, p. 334, fig. 94.—? Not Gosse, 1853.

DESCRIPTION.—Length up to 87 mm., width up to 8 mm., segments 15–34 (of which 4–14 may form the tail region). Body widest in the region of parapodia 4 or 5, tapering gradually posteriorly, then abruptly in the cylindrical tail region (provided with rudimentary parapodia only). With parapodial rosette organs (yellow in life; yellowish brown when preserved) on the inner sides of the ramal tips (fig. 25*b*) as well as on the ventral rami of the first 2 pairs of parapodia; with chromophile glands (colorless or gray; deeply stained with hematoxylin) rather small, found ventrally on pinnules of ventral rami; without hyaline glands. Gonads develop in both dorsal and ventral rami.

Biology.—The species has been studied in some detail by Southern (1911), Huntsman (1921), and Bigelow (1928). Individuals frequently appear in the Gulf of Maine, though never forming an important constituent, quantitatively speaking. Found chiefly outside the outer islands and rarely in estuarine waters tributary to the Gulf of Maine. Taken in every month of the year with no definite fluctuation in abundance from season to season, from the surface to 100 fathoms, migrating daily and coming to the surface most often at night. Reproduces during the summer in the Gulf of Maine, reproducing at least enough to maintain a rather sparse stock. Very

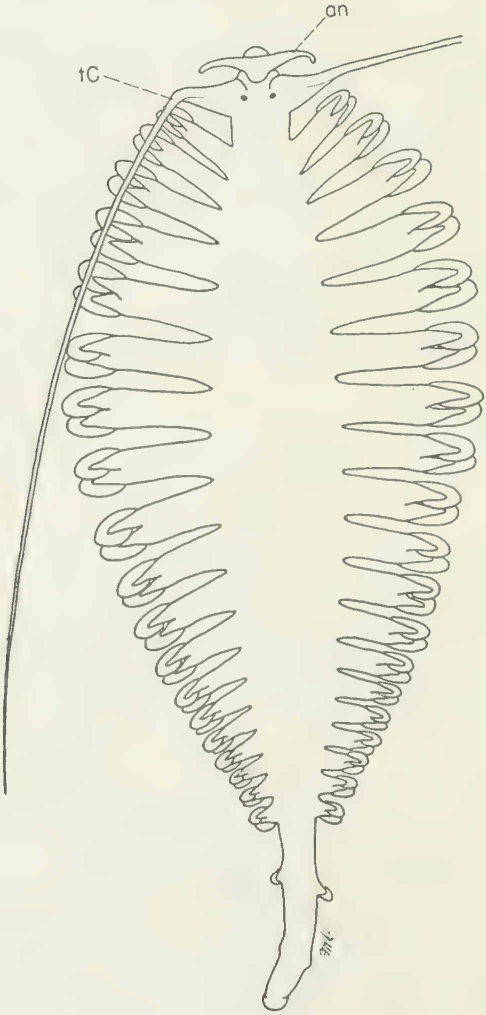

Figure 24.—Tomopteridae, *Tomopteris helgolandica*, dorsal view (drawn from type of *Tomopteris smithii* Verrill).

abundant in the Grand Banks off Newfoundland. Invades the shallow water near the Ireland coast. Breeds from May until August in Irish waters. Withstands temperatures from 15° to —1° C., optimum temperature being comparatively low. Its salinity range is 31 to 34 °/₀₀ (above 34 in Irish waters). Seems to be chiefly a coastal form.

MATERIAL EXAMINED.—Numerous specimens from the Gulf of Maine to north of Bahama Bank, surface to 133 fathoms. Also type of *T. smithii* Verrill from Eastport, Maine.

DISTRIBUTION.—Grand Banks off Newfoundland, Gulf of Maine to north of Bahamas, North Sea around Ireland, English Channel to off Portugal, Mediterranean, Sargasso Sea, off South America (mouth of Amazon River), Indian Ocean. Surface to 1,000 fathoms.

***Tomopteris septentrionalis* Steenstrup, 1849**

FIGURE 25*c*

Tomopteris septentrionalis Southern, 1911, p. 20.—Fauvel, 1923, p. 224, fig. 84*d*.—Huntsman, 1921, p. 90.—Bigelow, 1928, p. 340.—Wesenberg-Lund, 1936, p. 4; 1951, p. 32; 1953, p. 34.—Støp-Bowitz, 1948a, p. 49, figs. 36, 37; 1949, p. 12.—Kielhorn, 1952, p. 236.—Uschakov, 1955, p. 110, fig. 13.—Dales, 1955, p. 440; 1957, p. 145, figs. 51, 52.—Berkeley and Berkeley, 1957, p. 575.—Tebble, 1960, p. 176, fig. 8.

DESCRIPTION.—Length up to 22 mm., width up to 6 mm., segments 17–24. Body oval lanceolate, attenuated posteriorly, without a tail region. Both parapodial hyaline and chromophile glands at the apex of the pinnule of the ventral ramus, the hyaline glands (unaffected by hematoxylin) small, indistinct, may appear faint reddish brown; chromophile glands (colorless, deeply stained by hematoxylin) ventral to the hyaline glands. Gonads develop in dorsal rami only (fig. 25*c*).

BIOLOGY.—Characteristically an oceanic species found in deep-sea areas where it may dominate the pelagic community of the surface. Found at all depths to 900 fathoms but especially abundant in surface waters. A eurythermic species, inhabiting the cold and temperate waters of both hemispheres. Breeding season probably prolonged over a long interval, reaching its maximum in the months of autumn in West Greenland waters (Wesenberg-Lund, 1936). In the Labrador Sea, specimens caught generally in night surface tows, both adults and juveniles occurring together through the year (Kielhorn, 1952). Comparatively insignificant in percentage of the total population, but probably exerts a noticeable effect in the economy of the region. Voracious predator, preying on almost all of the other animals of digestible size. Dales (1955, 1957) found it to be the most abundant species of *Tomopteris* in the collections made off the Pacific coast of North America, it being most common north of San Francisco,

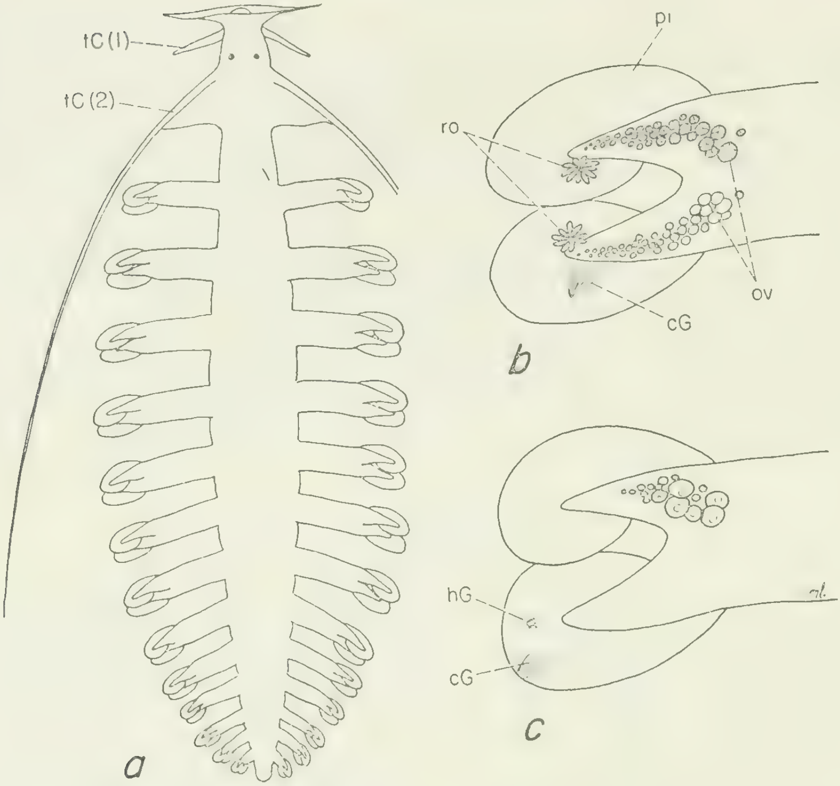

FIGURE 25.—Tomopteridae, *a–b*, *Tomopteris helgolandica: a*, dorsal view young specimen (after Emerton, *in* Hartman, 1944a); *b*, parapodium (after Moore, 1903b). *c*, *Tomopteris septentrionalis*, parapodium.

where it appeared to be a cold-water coastal form (perhaps due to the rapid shelving and upwelling in this region).

MATERIAL EXAMINED.—*Grampus* (*Bache*) Station 10166, off South Carolina (32°33′ N., 72°14′ W., 100–0 meters, January 30, 1914), *Albatross* Station 20107, Eastern Channel between Browns and Georges Banks (42°19′ N., 66°02′ W., 140–0 meters, April 16, 1920), Station 20129, Continental edge off Nantucket shoals (40°05′ N., 69°04′ W., 100–0 meters, May 17, 1920).

DISTRIBUTION.—Cosmopolitan, Arctic, North Atlantic (off Norway to Canaries, Baltic, North Sea, Mediterranean, Davis Strait to off South Carolina), South Atlantic (off Africa), Antarctic, North Pacific (Japan, British Columbia to central California), South Pacific (off Chile, New Zealand). Surface to 900 fathoms.

Family Typhloscolecidae

Exclusively pelagic. Body small, fusiform or cylindrical, transparent. Prostomium conical, sometimes terminating in a slender palpode, without eyes. A pair of prominent nuchal organs. Tentacular cirri 3 pairs, foliaceous, curled forward, lateral to and enclosing prostomium and anterior part of body. Parapodia uniramous, with lobes much reduced, with a few short acicular setae, with foliaceous dorsal and ventral cirri. Pair of foliaceous anal cirri.

Contains only one New England genus.

Genus *Travisiopsis* Levinsen, 1885

Type (monotypy): *Travisiopsis lobifera* Levinsen, 1885.

Both species have the body short, cylindrical, slightly attenuated at both ends, the posterior end evidently forming an effective swimming organ. They are colorless or yellowish, almost transparent. Prostomium conical, with a projecting median papilla or caruncle, with a pair of ciliated nuchal organs. Tentacular cirri 3 pairs, spoon-shaped, curled forward enclosing prostomium and anterior end of body. Parapodia uniramous, with setal lobes only slightly projecting, with a few acicular setae. Dorsal and ventral cirri large, leaflike, nearly square shaped in middle of body, becoming elongate-lanceolate posteriorly. A pair of large anal cirri, spatulate, slender basally, broadest distally, with a thickened hyaline rib in the middle.

Key to the New England Species of *Travisiopsis*

1. Nuchal organ encircling the median papilla or prostomial caruncle laterally and anteriorly (fig. 26*a*). . . . . **T. lobifera**
   Nuchal organ not extending anterior to caruncle (fig. 26*b*) . . **T. levinseni**

Travisiopsis lobifera Levinsen, 1885

FIGURE 26*a*

Travisiopsis lobifera Fauvel, 1923, p. 229, fig. 86,*a-d;* 1953, p. 139, fig. 71,*a-d.*—Støp-Bowitz, 1948a, p. 57, fig. 44.—Dales, 1955, p. 442; 1957, p. 148, figs. 58, 59.—Berkeley and Berkeley, 1957, p. 577.—Tebble, 1960, p. 196, fig. 13a.

DESCRIPTION.—Length up to 30 mm., width up to 3 mm., segments 21. Median papilla or caruncle oval. Nuchal organ consists of a pair of lobes encircling the caruncle laterally and anteriorly and projecting posteriorly as a short free lobe (fig. 26*a*).

MATERIAL EXAMINED.—*Grampus* (*Bache*) Station 10166, off South Carolina (32°33′ N., 72°55′ W., 100–0 meters, January 30, 1914); Station 10209, north of Bahama Bank (27°57′ N., 78°15′ W., 100–0 meters, March 22, 1914).

DISTRIBUTION.—Off Azores, Canaries, Arabian Sea, off Nova Scotia to Bahamas, northeast Pacific (off Oregon to Lower California), Indian Ocean, South Atlantic. Surface waters to 280 fathoms.

Travisiopsis levinseni Southern, 1910

Figure 26*b*

Travisiopsis levinseni Southern, 1911, p. 32, pl. 2, figs. 7–10.—Fauvel, 1923, p. 229, fig. 86,*h–k*.—Wesenberg-Lund, 1936, p. 12, figs. 4–5; 1951, p. 33.—Støp-Bowitz, 1948a, p. 59, fig. 47; 1949, p. 19.—Dales, 1955, p. 442; 1957, p. 150.—Tebble, 1960, p. 197, fig. 13*b*.

Description.—Length up to 30 mm., width up to 1.5 mm., segments 25. Median papilla or prostomial caruncle wide, flat, subrectangular. Nuchal organ consists of a pair of short undulating lobes extending laterally and posteriorly to the caruncle (fig. 26*b*).

Material examined.—*Albatross* Station 2045, southwest Martha's Vineyard, Massachusetts (40°04′ N., 68°43′ W., July 31, 1883; Station 2194, 39°43′ N., 70°07′ W., surface, August 5, 1884).

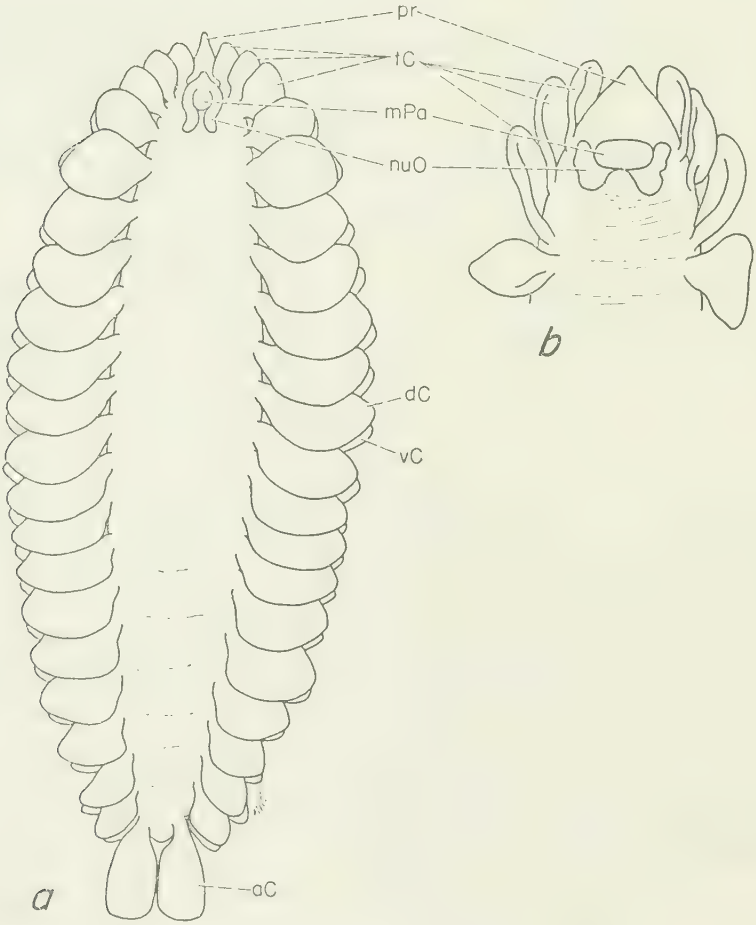

Figure 26.—Typhloscolecidae, *a*, *Travisiopsis lobifera*, dorsal view. *b*, *Travisiopsis levinseni*, dorsal view anterior end (after Wesenberg-Lund, 1936).

DISTRIBUTION.—Davis Strait, off Newfoundland to south of Massachusetts, south Iceland, off Ireland, Azores, Mediterranean, Arabian Sea, South Atlantic, Antarctic, northeast Pacific (off California), South Pacific (New Zealand). Surface to perhaps deep abyssal (<1,055 fathoms).

Family Hesionidae

Body small to moderate in size. Prostomium distinct, suboval to subquadrangular, usually with 4 eyes (0, 2, or 4), 2 or 3 antennae, 2 palps (may be biarticulate). Tentacular segments 1 to 4, achaetous, more or less distinct, with 2 to 8 pairs of tentacular cirri. Parapodia biramous or subbiramous; notopodia may be reduced to acicula in the cirrophores of the dorsal cirri, with notosetae simple or lacking. Neurosetae compound, with terminal blades long to short. Dorsal cirri short to long, smooth or more or less distinctly articulated; ventral cirri shorter, about the length of the neuropodia; 2 anal cirri. Carnivorous. Proboscis cylindrical, eversible, with or without marginal papillae, with or without horny jaws. Often conspicuously and brilliantly colored.

A number of hesionid species show commensalistic tendencies. Many are highly active and irritable, darting back and forth when touched. They may break up rather easily; some swim readily.

Key to the New England Genera of Hesionidae

1. Tentacular cirri 6 pairs on 3 distinct segments (segments not crowded or reduced (fig. 27*a*)). With anal plate in addition to short anal cirri, an entire flattened disc (fig. 27*c*) or bilobed plate (fig. 27*b*). Prostomium with 2 rudimentary eyes or eyes lacking, 2 lateral antennae, a median occipital antenna, 2 palps (fig. 27*a*) . . . . **Microphthalmus**
   Tentacular cirri 6–8 pairs on 3 to 4 anterior segments, some of which are crowded and reduced dorsally. Without anal disc, with a pair of long anal cirri only (fig. 29*b*). Prostomium with 4 eyes, 2 lateral antennae, 2 palps, with or without a median antenna (when present, anterior, not occipital; fig. 28*a*) 2
2. Prostomium with a short median anterior antenna, with biarticulate palps (fig. 28*a,c*). Notopodia rudimentary, reduced to acicula and few simple capillary notosetae (fig. 28,*b,d*) 3
   Prostomium without median antenna (fig. 29*a*). Tentacular cirri 6 pairs . 4
3. Tentacular cirri 6 pairs . . . . **Podarke**
   Tentacular cirri 8 pairs . . . . **Gyptis**
4. Palps biarticulate. Notopodia rudimentary, reduced to acicula in cirrophores of dorsal cirri, with or without few capillary notosetae; neuropodia with 3 conical lobes (fig. 28*e*) . . . . **Nereimyra**
   Palps unjointed (fig. 29*a*). Notopodia forming a distinct lobe with capillary notosetae; neuropodia diagonally truncate, without conical lobes (fig. 29*c*) . . . . **Parahesione**

Genus *Microphthalmus* Mecznikow, 1865

Type (monotypy): *Microphthalmus sczelkowii* Mecznikow, 1865.

Both species are of small size, vermiform, widest in the middle and attenuated at both ends, convex dorsally, flattened ventrally, with segments deeply incised. Prostomium rounded anteriorly and laterally, nearly straight to slightly concave posteriorly, with a pair of small posterolateral eyes (may be absent), with additional few scattered pigment granules, with a pair of filiform lateral antennae dorsally, a shorter pair of filiform palps ventrally, a slender occipital median antenna attached posteriorly (fig. 27*a*). Three distinct achaetous tentacular segments each with 2 pairs tentacular cirri, an upper and lower pair.

The tentacular cirri arise from inflated cirrophores, the styles being wide basally, tapering distally to slender tips. Tentacular cirri of first segment and lower pair of second segment nearly equal; upper pair of second segment about twice as long; upper pair of third segment still longer, lower pair about a fourth as long. Parapodia unequally biramous. Notopodia reduced to an aciculum and usually a single notoseta in the bulbous inflated cirrophore of the dorsal cirrus. Dorsal cirri short, digitiform, not extending much beyond the neurosetae. Neuropodia cylindrical, tapering to a bluntly conical lobe distally. Neurosetae compound, with blades long to short. Ventral cirri short, digitiform, extending about as far as the neuropodia. Eversible proboscis surrounded by a circle of conical papillae distally, without jaws (?).

Key to the New England Species of *Microphthalmus*

1. Anal or pygidial plate hood shaped, with border entire (fig. 27*c*). Body dotted with brown pigment in poorly defined transverse bands, and especially dark laterally . . . . **M. sczelkowii**
   Anal plate a flat bilobed structure (fig. 27*b*). Body white or only slightly dusky . . . . **M. aberrans**

Microphthalmus sczelkowii Mecznikow, 1865

FIGURE 27*c*

Podarke caeca Webster and Benedict, 1884, p. 706, pl. 1, figs. 6–8.—Miner, 1950, p. 300, pl. 99.

Microphthalmus sczelkowii Southern, 1914, pl. 45, pl. 5, fig. 6,*a–e*.—Fauvel, 1923, p. 250, fig. 93,*a–f*.—Uschakov, 1955, p. 197, fig. 59.—Rasmussen, 1956, p. 49, figs. 14–16.

Description.—Length up to 6 mm., width including setae up to 0.5 mm., segments up to 40. Notoseta simple, curved, lyrate. Color: body richly supplied with brown pigment scattered on the prostomium and anal plate, laterally near the bases of the parapodia

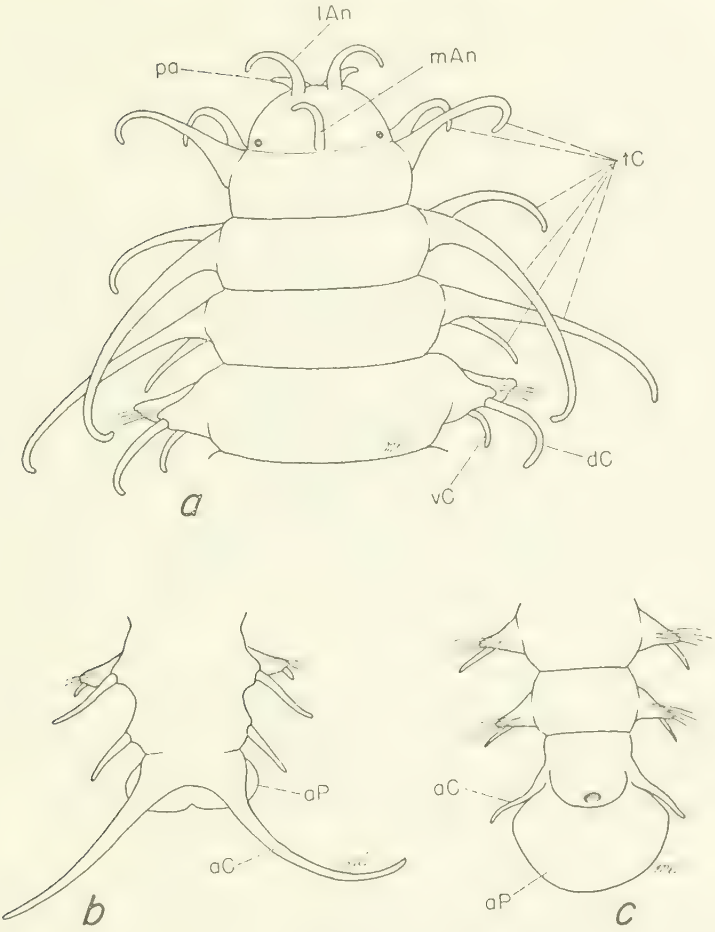

FIGURE 27.—Hesionidae, *a–b*, *Microphthalmus aberrans: a*, dorsal view anterior end; *b*, dorsal view posterior end. *c*, *Microphthalmus sczelkowii*, dorsal view posterior end.

both dorsally and ventrally, transversely banded dorsally in 2 to 4 poorly defined bands and ventrally in 4 irregular longitudinal bands.

Biology.—Found at low water in sand and rubble, under stones, and in shallow water on muddy bottom. According to Rasmussen (1956), they lay eggs in an irregular oval sticky mucous mass, probably early in the year. Adults massed with large yolky eggs in June (Barnstable Harbor, Massachusetts, June 22, 1959, H. Sanders).

Material examined.—Type of *Podarke caeca* from Provincetown, Massachusetts. Also Wellfleet Harbor, north shore, sandy rubble; Barnstable Harbor, 1959, H. Sanders.

Distribution.—Ireland, North Sea (Helgoland), Massachusetts (Cape Cod), north Japan Sea. Low water to 6 fathoms.

Microphthalmus aberrans (Webster and Benedict, 1887)

FIGURE 27,*a*,*b*

Podarke aberrans Webster and Benedict, 1887, p. 713, pl. 1, figs. 14–18, pl. 2, figs. 19–20.
Microphthalmus aberrans Southern, 1914, p. 46, pl. 5, fig. 7.

DESCRIPTION.—Length up to 9 mm., width including setae up to 1 mm., segments up to 51. Notoseta simple, curved, spinous. Proboscis with 10 wide conical papillae around opening. Color: white or may be slightly dusky. Appears to be hermaphroditic, with sex products (white eggs) massed from setiger 10 to end of body, with a copulatory structure (on left side between setigers 2 and 3), and viviparous (1 specimen had fertilized eggs and ciliated larvae inside).

BIOLOGY.—Found at low water in sand and gravelly sand. Found associated with two terebellids, crawling on the surface of the body and among the numerous oral tentacles of *Lysilla alba* Webster and *Enoplobranchus sanguineus* (Verrill). Adults massed with eggs were found in June (West Falmouth Harbor, Massachusetts, June 26, 1954).

MATERIAL EXAMINED.—Types from Eastport, Maine. Also Maine (Cape Newagen, Southport Island, Boothbay Harbor), New Hampshire (Rye Harbor; Fort Stark, sand sievings, 1955, N. Riser), Massachusetts (West Falmouth Harbor, inside breakwater).

DISTRIBUTION.—Maine to Massachusetts. Low water.

Genus *Podarke* Ehlers, 1864

Type (designated by Hartman, 1959a): *Podarke agilis* Ehlers, 1864. Contains only one New England species.

Podarke obscura Verrill, 1873a

FIGURE 28,*a*,*b*

Podarke obscura Verrill and Smith, 1874, pp. 25, 88, 146, pl. 12, fig. 61.—Webster and Benedict, 1884, p. 706.—Webster, 1886, p. 135, pl. 5, figs. 17–18.—Treadwell, 1901a, p. 399.—Sumner, Osburn, and Cole, 1913, p. 616.—Hartman, 1944a, p. 338, pl. 34, fig. 2 (juvenile), pl. 23, fig. 12 (as *Castalia cincinnata*); 1944c, p. 16; 1945, p. 14.—Miner, 1950, p. 300, pl. VII, 1, VIII, 2.—Pratt, 1951, p. 330, fig. 452.—Costello, et al., 1957, p. 90.
? *Podarke guanica* Hoagland, 1919, p. 571, pl. 29, figs. 1–4.—Rioja, 1958, p. 235.
Podarke near *guanica* Hartman, 1951, p. 36, pl. 10, figs. 1–3.

DESCRIPTION.—Length up to 40 mm., width including setae up to 3 mm., segments up to 90. Body widest in the middle, tapering gradually posteriorly and less so anteriorly, convex dorsally, flattened ventrally, with segments deeply incised laterally. First tentacular segment not visible dorsally, with 2 pairs of tentacular cirri lateral to prostomium, next 2 tentacular segments distinct, each with 2 pairs of tentacular cirri. Tentacular cirri slender, without articulations, similar in shape and length to dorsal cirri. Dorsal cirri long, slender, articulated, alternately longer and shorter, about equal in length to body width. Neuropodia cylindrical, tapering to bluntly conical processes. Neurosetae compound, with blades long to short.

Proboscis eversible, with large inflated basal portion and smaller cylindrical terminal portion, without jaws or papillae. Color, in life: dark rusty brown or blackish dorsally and ventrally including prostomium, usually with lighter transverse bands—may be 3 per segment; eyes reddish; in alcohol: colorless.

Biology.—A small but active worm found at low water on muddy sand flats, under stones, among eelgrass, on shells, on pilings among hydroids, ascidians, etc. Dredged among shells, sponge masses, clumps of algae, especially common in "weed" in Vineyard Sound, among ascidians (as sandy *Amaroecium*). Found in salt ponds (Charlestown Pond, Rhode Island, H. P. Jefferies).

It shows commensalistic tendencies, having been found among the spines of the sea urchin *Lytechinus* and on the oral surface of echinoderms (Florida, Hartman, 1951), and with the terebellid *Lysilla alba* (West Falmouth Harbor, Massachusetts, 1954); it was also found inside the sea cucumber *Thyone* (Woods Hole; it came out when the cucumber was being injected with magnesium chloride solution, J. F. Hickok, August 1953).

It becomes sexually mature during July and August, the females appearing brown, with brownish eggs, the males cream colored. They may come out at night in vast numbers, swimming at the surface; they are attracted to light. The eggs are laid in the evening between 7 and 10 o'clock; artificial fertilization is possible if the eggs have been extruded, not otherwise (Treadwell, 1901). According to Moore (MS.), the species lends itself admirably for regeneration and grafting experiments. Bifid monsters and abnormalities of segmentation are common.

Material examined.—Type specimen from Vineyard Sound. Also numerous specimens from Massachusetts (Cape Cod, Vineyard Sound, Buzzards Bay), Rhode Island, Connecticut, North Carolina, Georgia, Florida (Cedar Keys, E. L. Pierce, March 9, 1955; Seahorse Key, J. Taylor, 1960), in low water to 458 fathoms.

Distribution.—Massachusetts (Cape Cod) to Florida, Gulf of Mexico (Florida, Mexico), Bermuda, West Indian region and Caribbean Sea. Low water to 458 fathoms; surface.

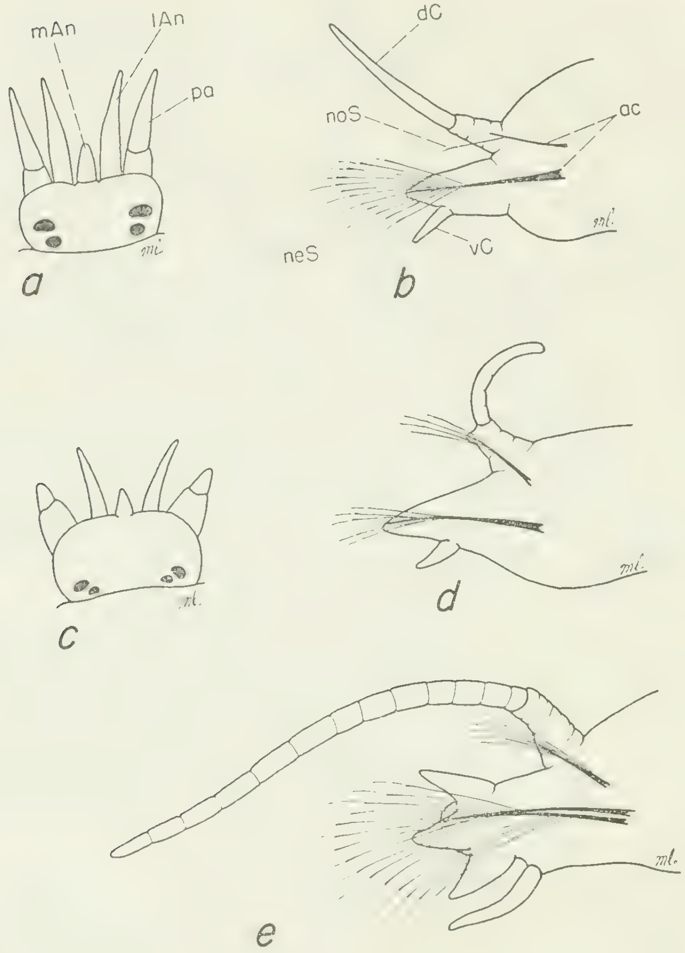

FIGURE 28.—Hesionidae, *a–b*, *Podarke obscura*: *a*, prostomium; *b*, parapodium. *c–d*, *Gyptis vittata*: *c*, prostomium; *d*, parapodium. *e*, *Nereimyra punctata*, parapodium.

Genus *Gyptis* Marion and Bobretzky, 1875

Type (monotypy): *Gyptis propinqua* Marion and Bobretzky, 1875. Contains only one New England species.

Gyptis vittata Webster and Benedict, 1887

FIGURE 28,*c*,*d*

Gyptis vittata Webster and Benedict, 1887, p. 716, pl. 1, figs. 21, 22, pl. 2, fig. 23.

DESCRIPTION.—Length up to 6 mm., width including setae up to 2 mm. Body widest in the middle region, tapering anteriorly and posteriorly, convex dorsally, flattened ventrally. First tentacular segment not visible dorsally, with 2 pairs tentacular cirri lateral to prostomium. Next 3 achaetous tentacular segments distinct but crowded, each with 2 pairs tentacular cirri. Tentacular cirri articulated, some longer than dorsal cirri, upper ones longer than lower ones. Notopodia a small conical lobe on the lower side of the cirrophore of the dorsal cirrus, with acicula and few (6 or so) capillary setae. Neuropodia elongate conical. Neurosetae compound, with appendages long to short. Dorsal cirri articulated. Ventral cirri shorter than neuropodia. Proboscis with a wide basal ring, a narrower more distal ring with a circle of papillae in the middle of the ring. Without color or with yellowish brown bands (in life).

BIOLOGY.—Found at low water under rocks. Dredged on bottoms of shells.

MATERIAL EXAMINED.—Type from Eastport, Maine; also Hadley Harbor, Woods Hole, Massachusetts.

DISTRIBUTION.—Maine to Massachusetts. Low water to 30 fathoms.

Genus *Nereimyra* Blainville, 1828

Castalia Savigny, 1820, preoccupied by Lamarck (1819, in Moll.); type (monotypy): *Castalia rosea* (Fabricius, 1780);=*Nereimyra punctata* (O. F. Müller, 1776).

Type designated by Støp-Bowitz, 1948a: *Nereimyra rosea* (Fabricius, 1780); =*Nereimyra punctata* (O. F. Müller, 1776). Contains only one New England species.

Nereimyra punctata (O. F. Müller, 1776)

FIGURE 28*e*

Castalia cincinnata Verrill, 1885b, p. 434.
Castalia punctata Fauvel, 1923, p. 240, fig. 89,*f–k*.—Wesenberg-Lund, 1951, p. 33; 1953, p. 35.—Banse, 1956, p. 17, figs. 1–8.—Clark, 1960, p. 18.
Eteone (*Mysta*) *barbata* Thorson, 1946, p. 62, fig. 27.—Not Malmgren, 1865.
Nereimyra punctata Støp-Bowitz, 1948a, p. 61.—Eliason, 1962, p. 240.
Castalia aphroditois Pettibone, 1954, p. 239, fig. 28, a, b; 1956, p. 554.

DESCRIPTION.—Length up to 25 mm., width including setae up to 4 mm., segments up to 50. Body thick anteriorly, tapered posteriorly, convex dorsally, flattened ventrally. A single tentacular segment visible dorsally, the 6 pairs of tentacular cirri crowded, lateral to prostomium, some longer than dorsal cirri, upper ones longer than lower ones, articulated, with large cirrophores. Dorsal cirri long, articulated. Notopodia reduced to acicula in the cirrophores of the dorsal cirri and a few simple capillary setae (setae may be lacking). Neuropodia with extra upper and lower conical lobes in addition to the middle conical acicular lobe (fig. 28*e*). Neurosetae compound, with terminal blades long to short. Proboscis barrel shaped, with raised lateral lobes near base, with 10 papillae around opening, a pair of ventral ridges just lateral to midventral notch (so-called "jaws"). Color, in life: yellowish with deeper transverse bands which may form dots in the posterior region.

BIOLOGY.—Found at low water, under stones, in crevices of rocks, in holdfasts of algae (as *Laminaria*), among oysters. Dredged on bottoms of coarse to fine sand, mud, silt, rocks, gravel, with old shells, and serpulid tubes. The early development has been followed by Banse (1956). The reproductive period begins in early summer, the larvae becoming important in the autumn plankton (in the Oersund, they belong to the 4 most abundant larvae of the errant polychaetes, see Thorson, 1946, as *Eteone barbata*, p. 62, fig. 27; see also Banse, 1956). The eggs are large and yolky and develop into yolky, drop-shaped, rather undifferentiated larvae which swim with the aid of a prototroch. The larvae of 7–8 segments sink to the bottom. The young stages develop a transitory unpaired prostomial antenna between the eyes; also the second and third tentacular segments develop transitory setae. In the young of 18 segments, the parapodia show the characteristic form of the adult.

MATERIAL EXAMINED.—Type of *Castalia cincinnata* Verrill from off Chesapeake Bay. Also off Newfoundland, Gulf of St. Lawrence, Massachusetts, Rhode Island, North Carolina, 16 to 1,290 fathoms.

DISTRIBUTION.—Arctic, Bering Sea, Iceland, Norway to western Baltic, France, Azores, Hudson Bay, off Newfoundland to off North Carolina. Low water to 1,290 fathoms.

Genus *Parahesione* Pettibone, 1956b

Type (original designation): *Parahesione luteola* (Webster, 1880). Contains only one New England species.

Parahesione luteola (Webster, 1880)

FIGURE 29

Hesione agilis Webster and Benedict, 1884, p. 707, pl. 1, figs. 9–11.
Podarke luteola Webster, 1886, p. 135, pl. 5, figs. 19–20.
Parahesione luteola Pettibone, 1956b, p. 281, fig. 1,*a–c*.

DESCRIPTION.—Length up to 15 mm., width including setae up to 4 mm., segments up to 45. Body widest in middle, tapering gradually anteriorly and posteriorly, flattened dorsoventrally. A single tentacular segment visible dorsally, the 6 pairs of tentacular cirri crowded, lateral to prostomium (fig. 29*a*). Tentacular cirri long, slender, some longer than dorsal cirri, upper ones longer than lower ones. Notopodia a stout papilla below the cirrophore of the dorsal cirrus, with close-set bundle of numerous capillary notosetae (fig. 29*c*). Neuropodia stout, elongate, diagonally truncate. Neurosetae compound, with terminal blades long to short. Dorsal cirri longer than setae, articulated. Proboscis with a larger basal portion and narrower distal portion, with numerous fine papillae around opening. Color, in life: colorless or reddish yellow; preserved: greenish.

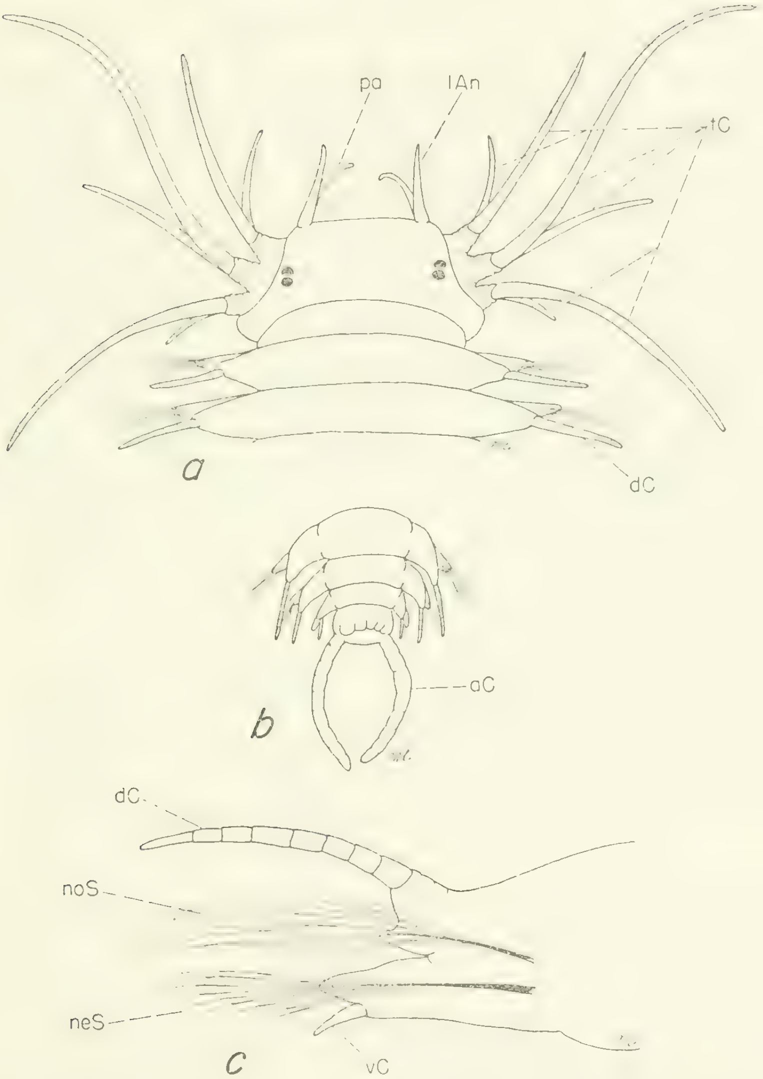

FIGURE 29.—Hesionidae, *Parahesione luteola: a*, dorsal view anterior end; *b*, dorsal view posterior end; *c*, parapodium.

BIOLOGY.—Found at low water on oyster shells in sandy mud flats and silty sand. Found on sandy flats with rubble, living commensally in the burrows of the ghost shrimp *Upogebia affinis* (Say). Moves rapidly and easily escapes notice. Some were massed with greenish eggs in July (Wellfleet Harbor, Massachusetts, July 3, 1954).

MATERIAL EXAMINED.—Type of *Hesione agilis*. Also Massachusetts (Wellfleet, Cape Cod), Georgia (Sapelo Island, mud, J. M. Teal), Florida (Seahorse Key, J. Taylor).

DISTRIBUTION.—Massachusetts (Cape Cod), New Jersey, Georgia (Sapelo Island), Gulf of Mexico (Florida). In low water.

Family Pilargiidae

A rather poorly defined family, the members of which are sometimes considered as aberrant hesionids or syllids. Body of small size, elongate, cylindrical to greatly flattened. Prostomium small and inconspicuous, with usually 3 antennae (0, 2 or 3), a pair of palps (large, small or absent; may be biarticulate), 4 eyes (0, 2 or 4). First or tentacular segment apodous and achaetous, may be more or less fused with prostomium, usually with 2 pairs tentacular cirri (may be lacking). Antennae and tentacular cirri may be short to long. Parapodia subbiramous, notopodia small, with 1 to few acicula, with or without heavy acicular spines. Neuropodia larger, with acicula and simple setae. Dorsal and ventral cirri present. Anal segment with or without a pair of anal cirri or anal plate. Integument may be papillated, areolated or smooth. Proboscis eversible, cylindrical or globular, usually without jaws, with or without papillae.

For more complete description of family, see Hartman (1947b). Contains only one New England genus.

Genus *Ancistrosyllis* McIntosh, 1879

Type (monotypy): *Ancistrosyllis groenlandica* McIntosh, 1879. Contains only one New England species.

Ancistrosyllis groenlandica McIntosh, 1879

Figure 30

Ancistrosyllis groenlandica McIntosh, 1879, p. 502, pl. 65, figs. 3, 20.—Southward, 1956, p. 260, fig. 1,*e–j*.

Description.—Length up to 40 mm., width up to 1.0 mm., segments up to 70. Body elongate, tapered slightly anteriorly and posteriorly, flattened dorsoventrally, with segments deeply notched laterally. Integument papillated, including body, parapodia and cirri (fig. 30,*a–e*). Prostomium (fig. 30,*a,b*) small, suboval, with pair large globular palps extending anteroventrally, with three short fusiform antennae, with pair large lateral eyes (according to McIntosh; not seen on specimens examined). Tentacular segment achaetous, somewhat fused dorsally with prostomium, with two pairs short fusiform tentacular cirri. Dorsal cirri of first setiger about twice as long as following; rest rather short, fusiform; ventral cirri shorter, fusiform.

Notopodium inconspicuous, with a slender embedded aciculum and, beginning on setigers 4 or 5, with a large hooked acicular seta placed above the dorsal cirrus (fig. 30,*a,c,d,f*). Neuropodium forming a prominent lobe, with acicula and bundle of simple setae. Neurosetae longer and shorter, both kinds tapering to slender, slightly hooked tips. Anal end rounded, with pair of short ventral anal cirri (fig. 30*c*). Proboscis short, cylindrical, with few scattered papillae. Color, preserved: irregularly splotched with dark pigment dorsally, with rust-colored glandular areas at bases of dorsal hooked setae and below ventral cirri.

Biology.—Dredged on bottoms of mud, silty clay, sandy mud, and with shell and gravel.

Material examined.—North Atlantic (*Delaware* Station, 42°31′ N., 67°48′ W., 175 fathoms, 1959, R. Wigley; *Albatross* III, 42°10′ N., 69°18′ W., 100 fathoms, 1955, R. Wigley; *Albatross* Station 2212, 39°59′ N., 70°30′ W., 428 fathoms, 1884; Station 2213, 39°58′ N., 70°30′ W., 384 fathoms, 1884), Gulf of St. Lawrence.

Distribution.—Davis Strait, West Greenland, British Isles, Gulf of St. Lawrence to off New Jersey. In 25 to 428 fathoms.

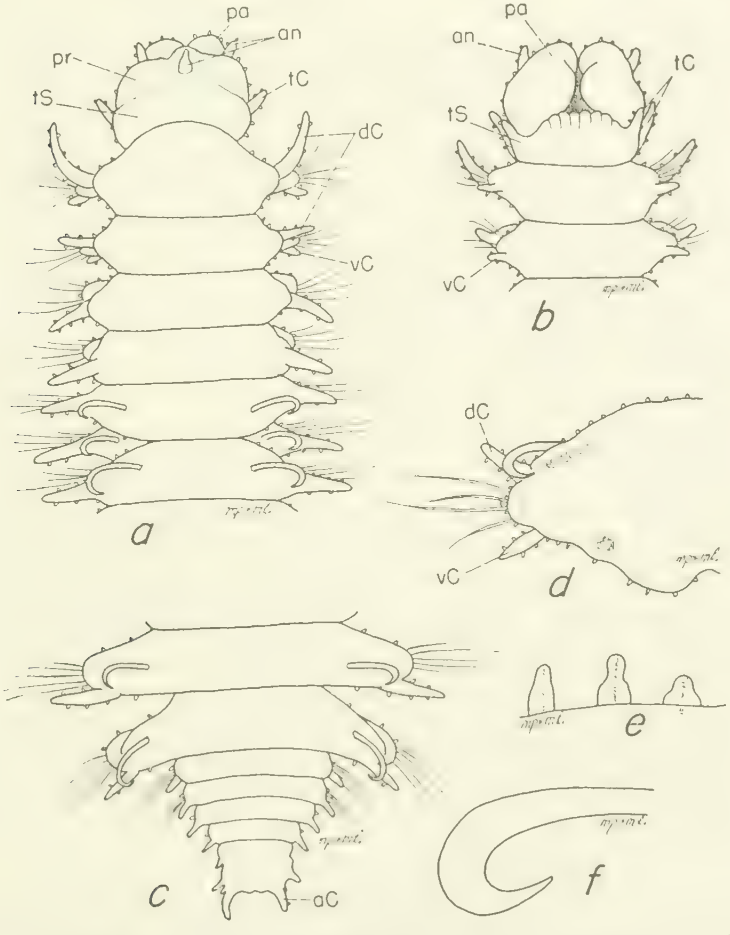

Figure 30.—Pilargiidae, *Ancistrosyllis groenlandica: a*, dorsal view anterior end; *b*, same, ventral view; *c*, dorsal view posterior end of specimen of 52 segments, with regenerating posterior end; *d*, right middle parapodium (setiger 31), anterior view; *e*, few papillae from dorsal surface; *f*, notopodial hooked acicular seta.

Family Syllidae

Body of small size. Prostomium with 4 eyes (sometimes with an additional minute anterior pair), 2 palps (may be reduced and fused), 3 antennae. Tentacular segment achaetous, with 1 or 2 pairs tentacular cirri. Parapodia uniramous (may be biramous in sexual forms), with dorsal and ventral cirri (latter may be absent). Anal cirri 2–3. Setae mostly compound (may be secondarily fused), sometimes with additional simple setae. Proboscis eversible, armed or not with one to several chitinous teeth. Carnivorous, living on sponges, hydroids, ascidians, etc.

The modes of reproduction are extremely varied in the group and may be rather complex and thus cause difficulties in their identification. They may be summarized as follows:

A. Reproduction direct (epigamy): The mature males and females become transformed into reproductive individuals or epitokes in which the whole animal becomes modified. The eyes become enlarged, long swimming setae develop in newly formed notopodia on a number of segments, and the body is filled with sex products, often becoming luminescent. They may leave the bottom and swarm in surface waters.

(1) Pelagic larvae: Eggs and sperm are given off into the water, developing into pelagic larvae (as in *Eusyllis* (fig. 33), *Odontosyllis*, *Syllides*, *Streptosyllis*, and *Amblyosyllis*).

(2) Gestation: Large yolky eggs become attached to the dorsal or ventral surface of the female where they are fertilized and develop into advanced nonciliated young of 5–6 segments (as in *Exogone*, *Brania*, *Sphaerosyllis*, and *Parapionosyllis*).

B. Reproduction indirect, by asexually formed stolons: A variable number of posterior segments become modified to form a sexual stolon, in which the segments become massed with sex products, long swimming setae develop in newly formed notopodia and a newly formed head develops on the anterior part, with four large eyes and various appendages. When more or less completely modified, the stolon breaks off from the stem form, the latter then regenerates a new posterior end. The stem form may form:

(1) Similar male and female stolons (chaetosyllis stage): Head appendages poorly developed, usually two antennae (2–3) and few small tentacular cirri (0–3 pairs); develop into pelagic larvae (as in *Syllis*, fig. 32,*d*,*e*).

(2) Sexually dimorphic male (polybostrichus stage) and female (sacconereis stage) stolons: Head appendages well developed, three antennae, 1–3 pairs tentacular cirri; female with large yolky eggs carried in a large ventral sac where the embryos pass through their early stages of development (as in *Autolytus*, figs. 37–40).

Key to the New England Genera of Syllidae

1. Body exceedingly tiny, linear, threadlike. Antennae, tentacular and dorsal cirri short, fusiform or subulate. Tentacular cirri 1–2 pairs. Reproduction direct (epigamy), forming sexual epitokes with swimming setae at maturity; with large yolky eggs and developing young attached to body of female (gestation) 2

   Body larger. Antennae, tentacular and dorsal cirri longer, filiform or clavate. Tentacular cirri 2 pairs 5

2. Tentacular cirri 2 pairs, similar to antennae and dorsal cirri (fig. 35*b*). **Brania** (p.133)

   Tentacular cirri 1 pair (fig. 35,*a*,*d*,*e*) 3

3. Tentacular cirri rudimentary, smaller than dorsal cirri (fig. 35*d*). Antennae and dorsal cirri clavate to cylindrical, not inflated basally . **Exogone** (p. 129)

   Tentacular cirri similar to dorsal cirri. Antennae and dorsal cirri wider basally, tapering to slender tips 4

4. Palps fused on basal third (fig. 35*e*). Body smooth, without surface papillae. **Parapionosyllis** (p. 132)

   Palps fused for nearly their entire length (fig. 35*a*). Body covered with adhesive papillae, often incrusted with mud . . . **Sphaerosyllis** (p. 135)

5. Without vental cirri (fig. 38*c*). Prostomium with palps poorly developed or wanting, fused, turned ventrally (fig. 38*b*). Antennae and dorsal cirri smooth. Reproduction by sexually dimorphic stolons, produced singly (fig. 38*a*) or in chains (fig. 40*a*) . . . . **Autolytus** (p. 137)

   With ventral cirri (fig. 32*b*) 6

6. Body short, flattened, with segments few (about 15). With a pair of ciliated nuchal epaulettes (fig. 34*e*) . . . . **Amblyosyllis** (p. 128)

   Body subcylindrical, with segments more numerous. Without nuchal epaulettes 7

7. Ventral cirri elongate, slender, extending beyond parapodial lobes (fig. 31*k*). Antennae and at least some of dorsal cirri clavate, inflated distally . . . 8

   Ventral cirri not extending beyond setal lobes. Antennae and dorsal cirri filiform 9

8. With enlarged knobbed acicula in certain number of anterior segments (fig. 31*k*) . . . . **Streptosyllis** (p. 126)

   Without enlarged knobbed acicula . . . . **Syllides** (p. 124)

9. With a semicircular nuchal hood on tentacular segment, covering posterior part of prostomium (fig. 35*c*). Proboscis with a circlet of large recurved teeth . . . . **Odontosyllis** (p. 122)

   Without a semicircular nuchal hood (it may be low and crescent-shaped, fig. 31*n*). Proboscis with a single large dorsal tooth 10

10. Antennae and dorsal cirri distinctly moniliform (fig. 32, *a*, *b*). Reproduction usually by stolons (chaetosyllis stage). Proboscis with smooth chitinous rim . . . . **Syllis** (p. 113)

    Antennae and dorsal cirri smooth or indistinctly articled. Reproduction direct (epigamy), forming sexual epitokes with swimming setae at maturity. Proboscis with finely denticled chitinous rim (fig. 31*p*) . **Eusyllis** (p. 118)

Genus *Syllis* (Savigny, MS.) Lamarck, 1818

Type (monotypy): *Syllis monilaris* (Savigny, MS.) Lamarck, 1818. The 3 species represented have the body elongate, slender, with numerous segments, flattened ventrally, arched dorsally, tapering slightly anteriorly and gradually posteriorly. Prostomium suboval, wider than long, with 3 moniliform antennae; 2 palps wider basally, well separated except where their inner basal sides may be fused (fig. 32*a*). Tentacular and dorsal cirri distinctly moniliform throughout body, tending to be alternately slightly longer and shorter (fig. 32, *a*, *b*). Ventral cirri digitiform, about the length of the parapodial lobes. Anal cirri 3, the lateral pair long, articulate, the median one a short style. Anterior end of extended proboscis with a smooth chitinous rim, a single large dorsal tooth, with a ring of 10 short papillae (with or without an additional ring of papillae more basally).

Key to the New England Species of *Syllis*

1. With simple setae only on all the segments (blades of compound setae partially or completely fused to shaft, with articulations obscure or absent (fig. 31, *g–h*). Dorsal cirri with 40–70 articles. Sexual stolon (chaetosyllis stage) unknown . . . . **S. spongiphila** (p. 114)

   With compound setae with articulations distinct, at least in anterior and posterior segments. With a sexual stolon (chaetosyllis stage) 2

2. Some median segments with heavy, bifurcated simple setae (blades of compound setae completely fused to shafts, fig. 32*c*). Dorsal cirri with 7–16 articles (fig. 32*b*). Sexual stolon (chaetosyllis stage) with three beaded antennae, with or without tentacular cirri (0–3 pairs, fig. 32*d*). **S. gracilis** (p. 116)

   All setae compound, with long and short distal blades (fig. 31, *i–j*). Dorsal cirri with 11–40 articles. Sexual stolon (chaetosyllis stage) with a single pair of beaded antennae, without tentacular cirri . . . **S. cornuta** (p. 118)

***Syllis spongiphila* Verrill, 1885b**

FIGURE 31,*g*,*h*

Syllis spongiphila Verrill, 1885b, p. 435.—Hartman, 1944a, p. 339, pl. 24, fig. 10.

DESCRIPTION.—Length up to 25 mm., width without setae 1.3 mm. Prostomium with 2 pairs of eyes in trapezoidal arrangement, with 3 beaded antennae, median one longer than lateral pair. Parapodia with setae few in number (2–4), simple, formed of blades which are partially fused to the stem or shaft (in anterior region, fig. 31*g*) to completely fused (in middle and posterior regions, fig. 31*h*), with tips minutely bidentate or entire. Dorsal cirri long, widest basally, tapering gradually, with about 50 articles (40–70). Colorless or yellowish white.

BIOLOGY.—Dredged on bottoms of mud, sand, gravel, with shells, sponges, etc. It may be found curled back on itself in sponges, along with *Syllis cornuta* and *Eunice norvegica*.

MATERIAL EXAMINED.—Numerous specimens from off Massachusetts to off Chesapeake Bay, 81 to 317 fathoms.

DISTRIBUTION.—Off Massachusetts to off Chesapeake Bay. In 70 to 317 fathoms.

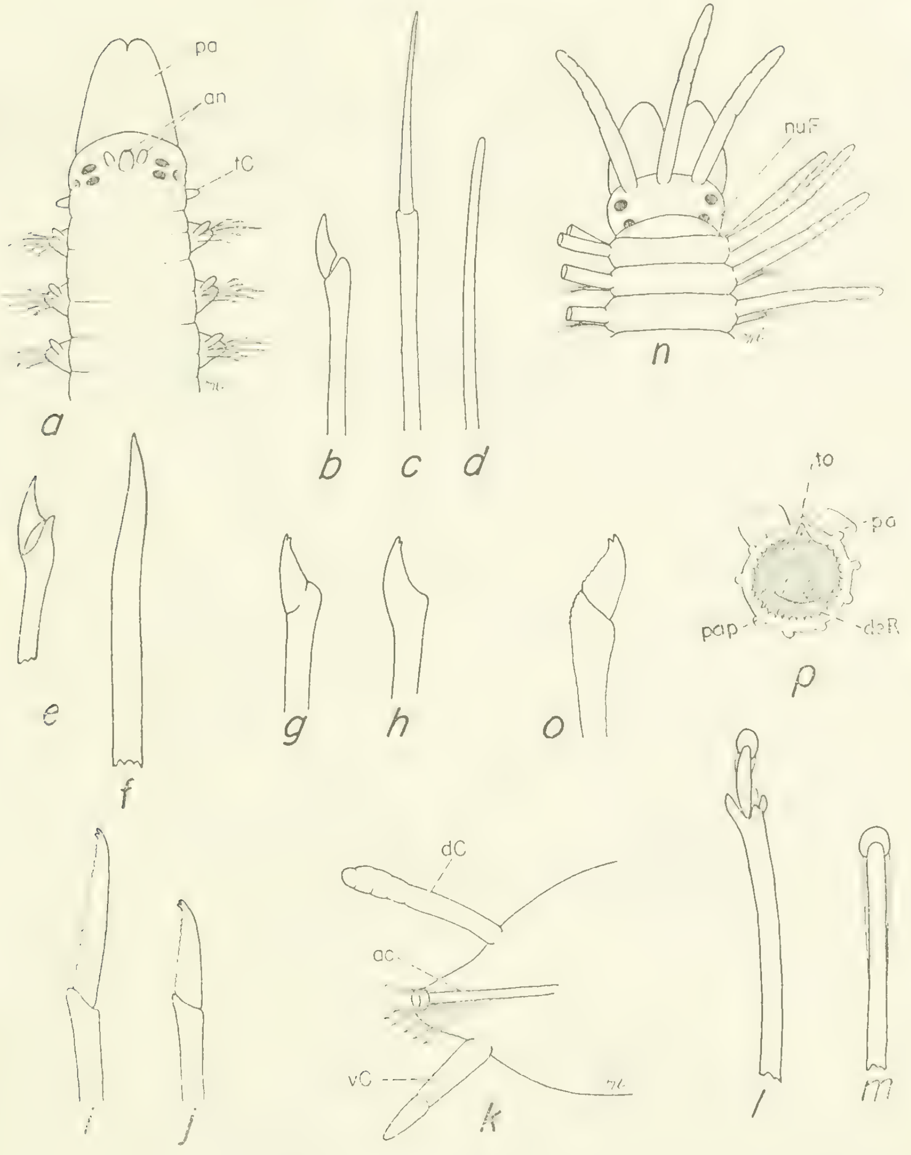

FIGURE 31.—Syllidae, *a–d*, *Exogone verugera: a*, dorsal view anterior end; *b*, compound falciger; *c*, compound spiniger; *d*, upper simple seta. *e–f*, *Exogone hebes* (after Webster and Benedict, 1884): *e*, compound seta from anterior parapodium; *f*, upper simple seta from middle of body. *g–h*, *Syllis spongiphila: g*, seta from anterior region (blade partially fused to shaft); *h*, seta from middle region (blade completely fused to shaft). *i–j*, *Syllis cornuta: i*, compound falciger from anterior region; *j*, same, with shorter blade. *k*, *Streptosyllis varians*, parapodium from anterior region. *l–m*, *Streptosyllis arenae* (after Webster and Benedict, 1884): *l*, compound seta; *m*, upper simple seta. *n–p*, *Eusyllis blomstrandi:* n, dorsal view anterior end; *o*, compound bidentate seta; *p*, frontal view extended proboscis showing distal row of papillae and denticled margin.

Syllis gracilis Grube, 1840

Figure 32

Syllis (*Syllis*) *gracilis* Webster, 1879, p. 217; 1886, p. 137.—Fauvel, 1923, p. 259, fig. 96,*f–i*; 1953, p. 147, fig. 73,*f–i;* 1955, p. 6; 1957b, p. 214.—Miner, 1950, p. 292, pl. 96.—Day, 1953, p. 412; 1957, p. 73; 1960, p. 309.—Tebble, 1955, p. 89.—Reish, 1959, p. 80.—Banse, 1959, p. 428.—Fauvel and Rullier, 1959, p. 514.

Synsyllis longigularis Hartman, 1942b, p. 48, figs. 76–82; 1945, p. 15, pl. 2, fig. 8; 1951, p. 42.

Description.—Length up to 50 mm., width up to 1 mm. Prostomium with 4 eyes in trapezoidal arrangement, with 3 antennae rather short, scarcely surpassing the palps, subequal. Dorsal cirri rather short, with about 10 articles (7–16). Parapodia of anterior and posterior regions with compound setae, with terminal blades rather short, hooked and fringed; middle segments with few (2–3), stout, bifurcated or Y-shaped simple setae formed by the fusion of the short blade to the stem or shaft (fig. 32*c*). Body colorless or transversely banded with light brown dots; eyes orange-red.

Sexual stolons or chaetosyllis stage formed from posterior ends of adults. Some posterior segments (12–37) become massed with developing eggs or sperm and drop off. After breaking off from the more anterior region of the body, a head region develops on the anterior part of the first segment of the stolon. One may find all stages as: (1) Small bilobed structure on anterior part of first setigerous segment; sex products massed in all segments except the first, no sign of modified setae; (2) oval head with 4 small eyes in trapezoidal arrangement, with a pair of short bulbous palps and 3 short antennae; sex products massed in body from second segment on, without modified segments; (3) completely modified stolons (fig. 32, *d*, *e*), with suboval head and 2 pairs of large orange eyes with lenses, 1 pair dorsal, 1 larger pair lateroventral, a pair of short bulbous palps ventrally, 3 beaded antennae; with or without tentacular cirri between the head and first setigerous segment (0–3 pairs). Anterior unmodified segments 1 to 3. Middle modified segments (19–35) with long capillary swimming setae between neuropodia and dorsal cirri. Posterior unmodified segments 1 to 3. The dorsal, ventral, and anal cirri and the neurosetae resemble those of the posterior end of the stem form, since the stolons are but modified tails which were dropped off from the adult worms; thus they lack the modified fused Y-shaped setae, except sometimes in the anterior few segments. Female stolons filled with large yolky, closely packed, coral pink or deep violet eggs. Male stolons massed with whitish or pale pink sperm masses. An abnormal stolon had 2 pairs of extra small eyes between segments 5 and 6, with long swimming setae beginning on segment 6.

Biology.—Found at low water, under stones, on algae, among barnacles, and oysters. Found among the scrapings of pilings, among sponges, tunicates, hydroids. Dredged among ascidians (as the sandy tunicate *Amaroecium pellucidum*), among bryozoan nodules, broken shells. In the Woods Hole region, adults with developing sex products in the tail region and detached developing sexual stolons were found in July and August (July 15, 1953, August 22, 1952, August 6, 1953).

Material examined.—Numerous specimens from Massachusetts (Woods Hole region, New Bedford, Cuttyhunk, Martha's Vineyard, Vineyard Sound, low water to 15 fathoms), Maryland (Ocean City, Rattlesnake, Hardy's Hole, Chincoteague Bay, low water).

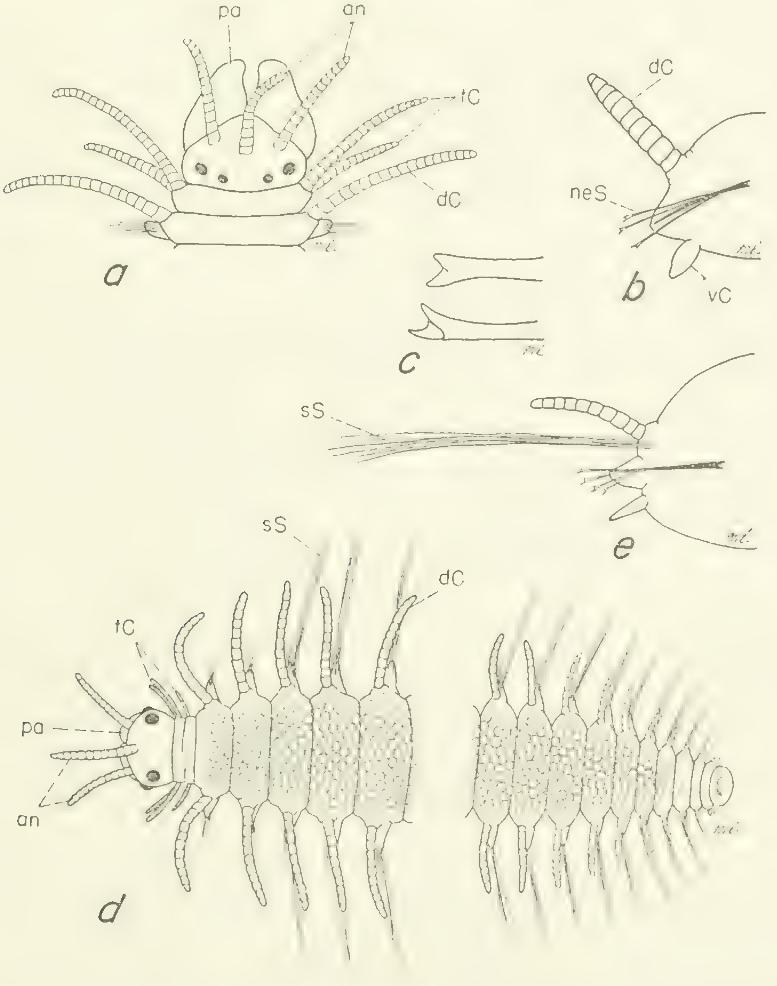

Figure 32.—Syllidae, *Syllis gracilis: a*, dorsal view anterior end; *b*, parapodium from middle region; *c*, neurosetae from middle segment; *d*, dorsal view anterior and posterior regions of female stolon or chaetosyllis stage; *e*, parapodium of same, with swimming setae.

DISTRIBUTION.—British Isles, France, Madeira, Azores, Canaries, Mediterranean, Massachusetts to Florida, Bermuda, West Indies, Black Sea, Red Sea, Persian Gulf, Indian Ocean, West and South Africa, southern California to Panama. In low water to 127 fathoms.

Syllis cornuta Rathke, 1843

FIGURE 31,*i,j*

Syllis pallida ? Verrill, 1875, p. 39, pl. 3, fig. 6.—Webster and Benedict, 1887, p. 717 (in USNM).—?Sumner, Osburn, and Cole, 1913, p. 615.

Syllis (*Ehlersia*) *cornuta* Fauvel, 1923, p. 267, fig. 100; 1953, p. 153, fig. 79,*g–i*; 1957b, p. 214.—Monro, 1939, p. 111.—Wesenberg-Lund, 1953, p. 35.—Pettibone, 1954, p. 253, fig. 28*f*.—Tebble, 1955, p. 90.—Banse, 1959, p. 429.—Fauvel and Rullier, 1959, p. 71.—Clark, 1960, p. 18.

Ehlersia cornuta Hartman, 1945, p. 15.

Ehlersia near *cornuta* Hartman, 1951, p. 42.

Syllis (*Ehlersia*) near *cornuta* Reish, 1959, p. 80.

DESCRIPTION.—Length up to 45 mm., width without setae up to 1.2 mm. Prostomium with 2 pairs of eyes, anterior pair larger, crescentric, with or without a pair of small ocular spots anterior to lateral antennae. Moniliform dorsal cirri with about 22 articles (11–40). Neurosetae all compound, with longer and shorter blades, the longer ones 2 4 times longer than the shorter ones, with fine marginal fringe extending to near the tip (fig. 31,*i,j*). Body colorless or with narrow reddish brown segmental transverse bands.

BIOLOGY.—Found at low water on mud and sand. Dredged on bottoms of sand, stones, rocks, with shells, sponges. Found in sponges along with *Syllis spongiphila* and *Eunice norvegica*. Sexual stolons have been observed in the plankton in the Alaskan Arctic in March and April (Pettibone, 1954).

MATERIAL EXAMINED.—Numerous specimens from Gulf of St. Lawrence, Nova Scotia, Maine, Massachusetts, Georgia (Sapelo Island), low water to 146 fathoms.

DISTRIBUTION.—Cosmopolitan. Widely distributed in the Arctic. Iceland, Norway to Madeira, Mediterranean, Gulf of St. Lawrence to Florida, Red Sea, South Arabian Coast, Persian Gulf, Indian Ocean, off West and South Africa, north Japan Sea, Alaska to Panama, South Pacific, Antarctic. In low water to 1,400 fathoms; sexual stolons in plankton.

Genus *Eusyllis* Malmgren, 1867

Type (designated by Hartman, 1959a, p. 204): *Eusyllis blomstrandi* Malmgren, 1867.

Both species have the body elongate, slender, flattened ventrally, arched dorsally, tapering slightly anteriorly and posteriorly. Prostomium suboval, wider than long, with 2 pairs fairly large red eyes, usually with an additional pair of small ocular spots near the palps.

Palps broad, flattened, united on basal third, changeable in form, often turned under ventrally (fig. 34*a*). Parapodia with setae compound, similar throughout; ventral cirri short, conical. Anterior border of proboscis with a circlet of papillae; anterior border of chitinous lining with a single large median tooth and finely denticled rim (fig. 31*p*). Mature forms becoming epitokous, with swimming setae forming on more posterior segments (figs. 33, 34*d*).

Key to the New England Species of *Eusyllis*

1. Tentacular segment with a distinct, wide, crescent-shaped nuchal fold covering the posterior part of the prostomium (fig. 31*n*). Distal blades of compound setae short, bidentate (fig. 31*o*). Dorsal cirri short, those of median and posterior regions shorter than body width. Ventral cirri of first setiger not enlarged . . . . **E. blomstrandi**

   Tentacular segment with a slightly marked ridge but not a distinct nuchal fold (fig. 33). Distal blades of compound setae longer, bidentate (fig. 34*b*). Dorsal cirri long—4 to 8 times as long as the body width. Ventral cirri of first setiger much larger than the following, flattened, foliaceous (fig. 34*a*). **E. lamelligera**

***Eusyllis blomstrandi* Malmgren, 1867**

FIGURE 31,*n–p*

Eusyllis phosphorea Verrill, *in* Smith, Harger, and Verrill, 1874, pp. 20, 39, pl. 7. fig. 2.—Hartman, 1944a, p. 338, pl. 25, fig. 4.

Eusyllis blomstrandi Fauvel, 1923, p. 293, fig. 112,*h–m*.—Pettibone, 1954, p. 260. fig. 28,*g–i*; 1956a, p. 555.

Description.—Length up to 32 mm., width without setae up to 1.2 mm., segments up to 124. Prostomium (fig. 31*n*) with median antenna up to 3 times the body width, lateral antennae half as long. Antennae, tentacular cirri, anterior dorsal cirri irregularly annulated, especially distally, more or less smooth basally; the more posterior dorsal cirri indistinctly annulated or smooth. Sexual epitokous forms with swimming setae beginning on setiger 17 (13-17), continuing to near posterior end. Body orange or yellowish.

Biology.—Dredged on bottoms of mud, sand, gravel, rocks, with hydroids, bryozoans, shells, worm tubes. A few were obtained in the oceanographic fouling studies in the New England region. They may form definite hardened mucous tubes. They are luminescent, giving off a bright green light. Sexual epitokous individuals have been found in Alaskan Arctic in August (Pettibone, 1954), in Labrador in June (Pettibone, 1956a).

Material examined.—Gulf of St. Lawrence (Bay of Chaleurs, south of Anticosti Island), Maine (Eastport, Mount Desert region), Massachusetts (Georges Bank, Nantucket), 20 to 120 fathoms.

Distribution.—Widely distributed in the Arctic. Also Iceland, Ireland to Mediterranean, Labrador to Massachusetts, Bering Sea to

Washington, north Japan Sea. In low water to 444 fathoms; sexual epitokes at surface.

Eusyllis lamelligera **Marion and Bobretzky, 1875**

FIGURES 33, 34,*a–d*

Eusyllis fragilis Webster, 1879, p. 217, pl. 4, figs. 42–43.—Sumner, Osburn, and Cole, 1913, p. 615.—Hartman, 1944a, p. 338, pl. 13, fig. 12, pl. 14, fig. 4.
Eusyllis tenera Verrill, 1882, p. 368.
Eusyllis lamelligera Fauvel, 1923, p. 294, fig. 113,*a–e*.—Banse, 1959, p. 433.

DESCRIPTION.—Length up to 15 mm., width without setae up to 0.5 mm., segments up to 50. Prostomium with median antenna very long (3 to 8 times the body width), lateral antennae about two-thirds as long. Antennae, tentacular and dorsal cirri smooth or irregularly wrinkled and not distinctly annulated. Sexual epitokous forms (fig. 33) with swimming setae beginning on about setiger 12 (11–14),

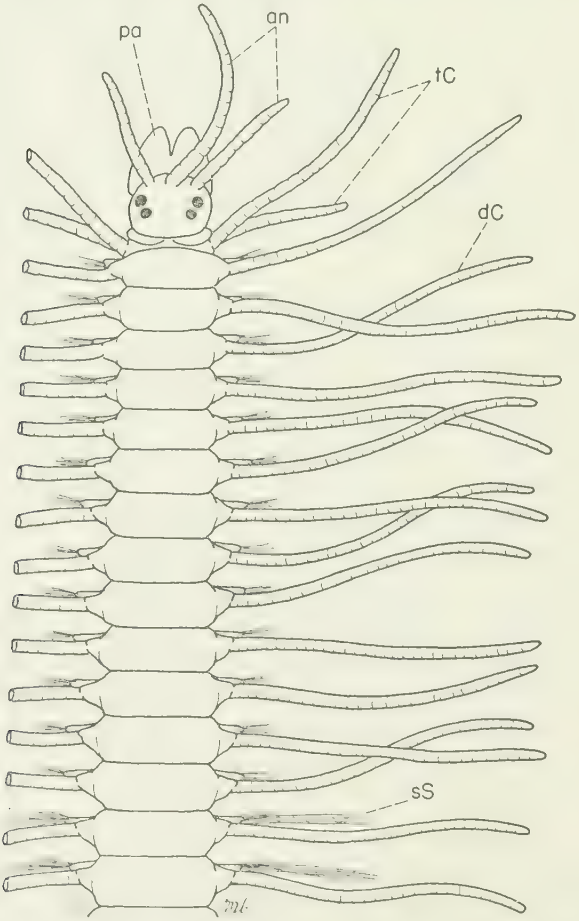

FIGURE 33.—Syllidae, *Eusyllis lamelligera*, dorsal view anterior end of sexual epitoke with swimming setae.

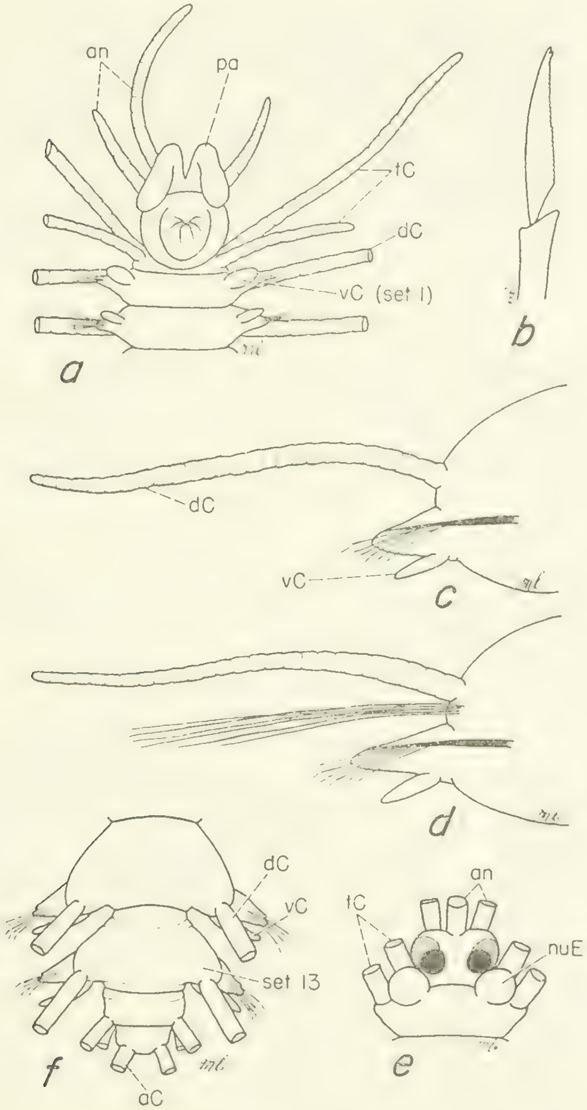

Figure 34.—Syllidae, *a–d*, *Eusyllis lamelligera: a*, ventral view anterior end; *b*, neuroseta; *c*, parapodium from anterior region; *d*, parapodium from posterior region of sexual epitoke. *e–f*, *Amblyosyllis finmarchica: e*, dorsal view anterior end, bases of antennae and cirri only shown; *f*, dorsal view posterior end, bases of dorsal and anal cirri only shown.

continuing to near the posterior end; females massed with purplish brown eggs; males filled with white sperm masses; a pair of brownish crescent-shaped glands on ventral surface at the base of each foot. Body yellowish white, translucent, with faint brownish lines between the segments and between the bases of the dorsal cirri and lateral surfaces of the parapodia.

Biology.—Dredged on gravelly and shelly bottoms, among bryozoans, sponges, ascidians (as *Amaroccium pellucidum*). In the Woods

Hole region, sexual epitokes appear in the surface waters during the last of July to the middle of September (Verrill, 1882).

MATERIAL EXAMINED.—Numerous specimens from Massachusetts (Woods Hole region, Vineyard Sound, Cape Cod Bay), Connecticut (Noank), Long Island Sound, North Carolina.

DISTRIBUTION.—Massachusetts to North Carolina, English Channel to Mediterranean. In 4 to 18 fathoms; sexual epitokes in surface waters.

Genus *Odontosyllis* Claparède, 1863

Type (monotypy): *Odontosyllis gibba* Claparède, 1863. Contains only one New England species.

Odontosyllis fulgurans Claparède, 1864

FIGURE 35c

Eusyllis lucifer Verrill, 1875, p. 39.

Odontosyllis lucifera Verrill, 1879, p. 170; 1881, pp. 314, 320, pl. 12, fig. 1; 1882, p. 368.—Sumner, Osburn, and Cole, 1913, p. 615.—Hartman, 1944a, p. 338, pl. 24, figs. 3–4.—Miner, 1950, p. 298.

Odontosyllis fulgurans Webster, 1879, p. 220; 1886, p. 137.—Fauvel, 1923, p. 274, fig. 103,*f–i*.—Miner, 1950, p. 298.—Banse, 1959, p. 430.

DESCRIPTION.—Length up to 22 mm., width without setae up to 1 mm., segments up to 100. Body flattened, strongly arched dorsally, fragile, breaking up easily. Prostomium suboval, notched posteriorly, with 2 pairs of rather large eyes and usually with an additional pair of minute ocular spots near the palps. Palps broad and short, well separated except at the base where they are fused, often curled ventrally. Antennae rather short, scarcely surpassing the palps, the median one longer than the lateral pair.

Tentacular achaetous segment with 2 pairs tentacular cirri, with a semicircular nuchal hood covering the posterior part of the prostomium, the border of the nuchal hood being ciliated (fig. 35*c*). Parapodia with compound setae with short bidentate blades. Dorsal cirri of first setiger longer than the antennae, the rest generally alternately longer and shorter, nearly equal to the body width; ventral cirri short and wide. Proboscis with 6–7 large recurved teeth. Body yellowish white.

When mature, form sexual epitokes; eyes become somewhat enlarged, swimming setae form between the neuropodia and the dorsal cirri, beginning on about setiger 19 (9–21), continuing to near posterior end; body of female massed with large white eggs (violet eggs, according to Fauvel); body of male filled with white sperm masses; in middle and posterior part of body (beginning on about setiger 12) with a pair of grayish crescent-shaped glands showing through ventrally on each segment.

Biology.—Found at low water, under rocks, in rocky tide pools, on wharf pilings among mussels, ascidians, sponges. Dredged on bottoms of sand, gravel, with bryozoan nodules, ascidians, as sandy *Amaroecium pellucidum.* In the Woods Hole region, sexual forms massed with sex products and with swimming setae in the process of forming have been found in July (July 15 and 17, 1953); sexual forms massed with sex products and with swimming setae have been found swimming in surface waters, mainly in the evening, during July,

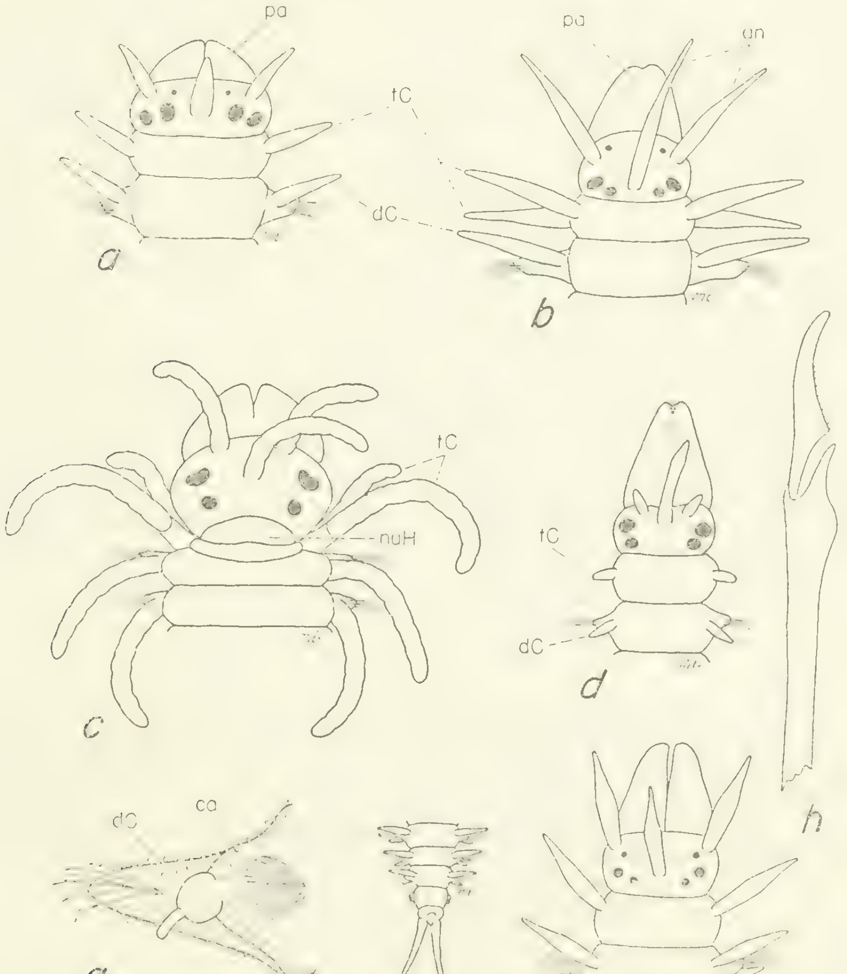

Figure 35.—Syllidae, *a*, *Sphaerosyllis erinaceus*, dorsal view anterior end. *b*, *Brania clavata*, dorsal view anterior end. *c*, *Odontosyllis fulgurans*, dorsal view anterior end. *d*, *Exogone dispar*, dorsal view anterior end. *e–f*, *Parapionosyllis longicirrata: e*, dorsal view anterior end; *f*, dorsal view posterior end. *g*, *Sphaerosyllis hystrix*, dorsal view parapodium. *h*, *Brania wellfleetensis*, compound seta.

August, and September. They are luminescent, with a bright green light.

Material examined.—Numerous specimens from Vineyard Sound, Massachusetts, low water to 15 fathoms; numerous sexual epitokes at surface.

Distribution.—Massachusetts to Virginia, English Channel, Mediterranean. In low water to 15 fathoms; sexual epitokes at surface.

Genus *Syllides* Oersted, 1845a

Type (monotypy): *Syllides longocirrata* Oersted, 1845a.

Both species have the body slightly flattened, wider in the middle region, tapering gradually anteriorly and posteriorly. Prostomium with 2 pairs of large red eyes and usually a pair of small ocular spots near the lateral antennae. Antennae, tentacular cirri, and first few dorsal cirri club shaped, inflated distally, smooth or feebly wrinkled. Rest of dorsal cirri more slender, tapering, distinctly articulated, tending to be alternately longer and shorter. Ventral cirri elongate, slender, extending beyond the parapodial lobes and, in the more posterior segments, may extend about as far as the tips of the setae. Parapodia uniramous, with a single (rarely 2) upper simple seta and numerous compound setae with blades short to long, tapering to fine bidentate tips. Anal cirri 3, a long articulate lateral pair and a short median one. Proboscis short, unarmed, with a circlet of papillae. When mature, they form sexual epitokes, eyes may be considerably enlarged, long capillary setae are formed above the neuropodia, and the sex products become massed in the more posterior segments.

Key to the New England Species of *Syllides*

1. Prostomial palps extend anteriorly, of about the same length as the prostomium (fig. 36*b*). Longest dorsal cirri with 14–25 articles. Sexual epitokes with swimming setae beginning on setigers 11–12 . . . . **S. longocirrata**
   Prostomial palps short, bulbous, extending ventrally, scarcely visible dorsally (fig. 36*a*). Longest dorsal cirri with 7–8 articles. Sexual epitokes with swimming setae beginning on setigers 8–9 . . . . **S. setosa**

Syllides longocirrata Oersted, 1845a

Figure 36*b*

Syllides convoluta Webster and Benedict, 1884, p. 709, pl. 2, figs. 12–16; 1887, p. 717.

Syllides longocirrata Webster and Benedict, 1887, p. 717.—Fauvel, 1923, p. 284, fig. 108,*a–g*.—Fyfe, 1952, p. 12.—Banse, 1959, p. 430.—Day, 1960, p. 310.—Wesenberg-Lund, 1962, p. 59.—Eliason, 1962, p. 241.

Syllides longocirratus Ehlers, 1897, p. 45.

Syllides longicirrata Marinov, 1959, p. 84, fig. 1.

Description.—Length up to 7 mm., width up to 1 mm., segments up to 50. Prostomium suboval, wider than long; palps usually extend anteriorly as earlike lobes, fused on their basal third. Single upper simple seta in each parapodial lobe, arched, tapering to a slender tip (seta may be shorter, curved or straight and blunt, as if broken off or worn down). Body colorless or yellow brown, dorsal cirri yellow, eggs greenish yellow; tentacular segment may be slightly raised and pigmented with golden dots.

Biology.—Found at low water in sand. Dredged on bottoms of sandy mud and gravel. According to Webster and Benedict (1887), it throws itself into a coil when disturbed. Sexual epitokes were found in surface water in July (Vineyard Sound, Massachusetts, July 26, 1883).

Material examined.—Massachusetts (Cape Cod Bay near Manomet Buoy, 14 fathoms; Vineyard Sound, surface, July 26, 1883).

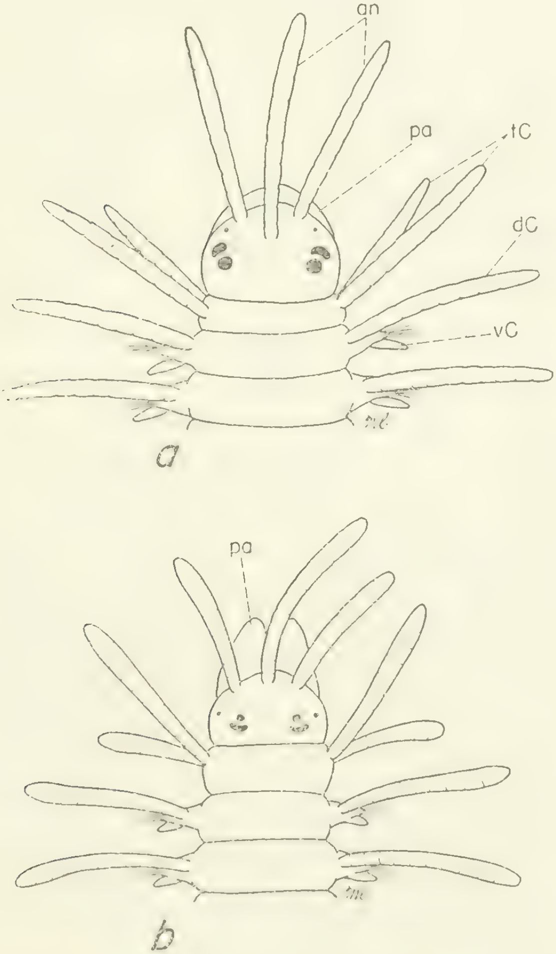

Figure 36.—Syllidae, *a*, *Syllides setosa*, dorsal view anterior end. *b*, *Syllides longocirrata*, dorsal view anterior end.

DISTRIBUTION.—Norway, English Channel, Baltic, Mediterranean, Adriatic, Black Sea, Maine to Massachusetts, Antarctic, New Zealand, South Africa, Chile. In low water to 25 fathoms; sexual epitokes in surface waters.

Syllides setosa Verrill, 1882

FIGURE 36*a*

Syllides setosa Verrill, 1882, p. 369.—Sumner, Osburn, and Cole, 1913, p. 615.—Hartman, 1944a, p. 339, pl. 24, fig. 11.
Syllides verrilli Moore, 1907, p. 448, figs. 1, 2.

DESCRIPTION.—Known only from the sexual epitokes found in surface waters. Length up to 3 mm., width up to 0.3 mm., segments up to 50. Prostomium subquadrate, closely united to tentacular segment; palps short, bulbous, directed ventrally, scarcely visible dorsally. Single upper simple seta bifid distally (appears to be a modified compound seta that has lost its blade and the distal bifid tip of the shaft has been worn down). Colorless or dull orange yellow.

BIOLOGY.—Sexual epitokes found in surface waters during summer months, in evening (June, July, August, September, Vineyard Sound, Massachusetts). Found on mussel beds (Moore).

MATERIAL EXAMINED.—Massachusetts (Fisheries Dock, Woods Hole, evening, at light, June 8, 1954).

DISTRIBUTION.—Massachusetts (Vineyard Sound). Low water; sexual epitokes in surface waters.

Genus *Streptosyllis* Webster and Benedict, 1884; emend. Southern, 1914

Type (monotypy): *Streptosyllis arenae* Webster and Benedict, 1884.

Both species have the body elongate, widest in middle third, tapering anteriorly and posteriorly, convex dorsally, flattened ventrally. Prostomium subquadrangular, with 3 pairs of eyes, anterior pair small, near lateral antennae, 2 more posterior pairs larger, closely approximated and may be merged, with 3 clavate or cylindrical antennae, with palps swollen basally and fused on inner part, distal half being conical, pointed. Tentacular cirri 2 pairs, similar to the antennae. Parapodia with an enlarged, knobbed aciculum in a certain number of anterior segments (fig. 31*k*); rest of segments with knobbed acicula but not especially enlarged. Setae of 2 kinds, a single (rarely 2) upper simple seta and numerous compound ones. Dorsal cirri variable, may be clavate or cylindrical, wrinkled irregularly or articulate. Ventral cirri nearly as long as or longer than the dorsal cirri. Anal cirri 3, a pair of long lateral ones and a short median one. Proboscis unarmed, with a circle of papillae.

Key to the New England Species of *Streptosyllis*

1. Parapodia with enlarged acicula in setigers 2 to 20 or 23. At least basal part of palps visible dorsally; distal conical part may be turned ventrally. **S. varians**
   Parapodia with enlarged acicula in setigers 2 to 5. Palps ventral, not visible dorsally . . . . **S. arenae**

Streptosyllis varians Webster and Benedict, 1887

FIGURE 31*k*

Streptosyllis varians Webster and Benedict, 1887, p. 718, pl. 2, figs. 24–31, pl. 3, figs. 32–34.—Not Fauvel, 1923, p. 281.

DESCRIPTION.—Length up to 8 mm., width up to 0.8 mm., segments up to 50. Upper simple seta curved, serrate near tip (not winged). Stem of compound setae with 2–3 terminal prongs; terminal blade of anterior parapodia very short; more posterior parapodia with blades somewhat longer, truncate, may have bifid tips, without covering membrane (as in *S. arenae*). Colorless. When mature, modified as sexual epitokes, with capillary swimming setae beginning on setiger 21; males with white sperm massed in body; females with few large polygonal white eggs.

BIOLOGY.—Found at low water, in coarse sand and gravel.

MATERIAL EXAMINED.—Rustico Harbor, Prince Edward Island, type specimens from Eastport, Maine.

DISTRIBUTION.—Gulf of St. Lawrence to Maine (Eastport). In low water.

Streptosyllis arenae Webster and Benedict, 1884

FIGURE 31,*l*,*m*

Streptosyllis arenae Webster and Benedict, 1884, p. 711, pl. 2, figs. 17–21, pl. 3, figs. 22–23.—Miner, 1950, p. 298, pl. 98.

DESCRIPTION.—Length up to 8 mm., width up to 0.5 mm., segments up to 55. Upper simple setae straight or slightly curved, bluntly rounded, with tips winged (covered by a membrane). Stem of compound setae with 4 terminal prongs; terminal blades of anterior parapodia very short; more posterior parapodia with blades short to longer, with tips covered by a membrane. Colorless or brownish yellow. Sexual epitokes unknown.

BIOLOGY.—Found at low water, in sand.

MATERIAL EXAMINED.—Type specimen from Provincetown, Massachusetts.

DISTRIBUTION.—Massachusetts (Cape Cod). In low water.

Genus *Amblyosyllis* Grube, 1857

Pterosyllis Claparède, 1863. Type (monotypy): *Pterosyllis formosa* Claparède, 1863.

Gattiola Johnston, 1865. Type (monotypy): *Gattiola spectabilis* Johnston, 1865; =*Amblyosyllis formosa* (Claparède, 1863).

Type (monotypy): *Amblyosyllis rhombeata* Grube, 1857. Contains only one New England species.

Amblyosyllis finmarchica (Malmgren, 1867)

FIGURE 34,*e,f*

Gattiola finmarchica Malmgren, 1867, p. 38, pl. 6, fig. 36.

Gattiola cincinnata Verrill, 1874b, p. 394, pl. 2, fig. (no description).

Pterosyllis cincinnata Webster and Benedict, 1887, p. 719.—Sumner, Osburn, and Cole, 1913, p. 615.

Pterosyllis finmarchica Annenkova, 1938, p. 152, fig. 4.—Uschakov, 1955, p. 187, fig. 54.

Amblyosyllis cincinnata Hartman, 1944a, p. 338, pl. 25, fig. 7.

Amblyosyllis lineata Miner, 1950, p. 292, pl. 96.—Not Grube, 1863.

DESCRIPTION.—Length up to 10 mm., width without setae up to 2 mm., segments 15 (13 setigerous, tentacular segment fused with prostomium, achaetous penultimate segment with 2 pairs long to short cirri, fig. 34*f*). Body short, flattened, composed of few deeply incised segments. Prostomium and fused tentacular segment with 3 long filiform antennae, 2 pairs large eyes, closely approximated, a pair of small palps appearing as 2 bosses on the ventral surface, not visible dorsally, 2 pairs long filiform tentacular cirri, the upper pair considerably longer than the lower pair, and a pair of prominent ciliated nuchal epaulettes. Dorsal and anal cirri long, slender, filiform, indistinctly to quite distinctly articulate, often coiled or spiralled. Ventral cirri extend about as far as the setigerous lobes. Setae compound, with terminal blades hooked, with tips entire. Proboscis very long, sinuous, armed with a circle of papillae and a circle of teeth.

When mature, become modified as sexual epitokes, eyes become enlarged, swimming setae develop, beginning on setiger 6 and continuing posteriorly. White, transparent, with dense yellowish material inside, beginning in setiger 5.

BIOLOGY.—Found at low water among boulders. Dredged on bottom of rocks and shells, in holdfasts of *Laminaria*. Young may appear in surface waters.

MATERIAL EXAMINED.—Newfoundland (Ferryland, low water, July 29, 1954, E. L. Bousfield), Maine (Eastport, Muscongus Bay near Hog Island, 2 fathoms).

DISTRIBUTION.—Finland, Newfoundland, Maine, north Japan Sea. Low water to 30 fathoms; surface.

Genus *Exogone* Oersted, 1845b

Paedophylax Claparède, 1868. Type (herein designated): *Paedophylax veruger* Claparède, 1868.

Type (monotypy): *Exogone naidina* Oersted, 1845b.

All 3 species are very tiny, slender, threadlike, tapered slightly anteriorly and more so posteriorly, flattened ventrally, arched dorsally. Prostomium suboval to subrectangular, much wider than long; palps much longer than the prostomium, fused dorsally into a rounded triangular mass, with or without an anterior notch, separated ventrally by a wide depression. Tentacular segment short, more or less distinct, the anterior part of which may form a fold covering the posterior part of the prostomium; with a single pair of tentacular cirri, smaller than the dorsal cirri; with a pair of ciliated nuchal organs between the eyes and tentacular cirri. Dorsal and ventral cirri shorter than the parapodial lobes. Anal cirri 2–3, rather long, subulate (median one may be short, fusiform). Everted pharynx crowned with a circle of papillae and a single conical tooth. With long swimming setae at maturity.

Large eggs, embryos or young (up to 5 setigers and resembling the adult) attached to ventral surface of female, 1 to 2 per segment on middle segments; young attached by a sort of peduncle of the anal segment to the parapodia of the female. They are sluggish, moving about very little.

Key to the New England Species of *Exogone*

1. Antenna short, subequal (fig. 31*a*). Anterior parapodia with setae of 3 kinds: simple curved upper one (fig. 31*d*), compound spinigers (fig. 31*c*), compound falcigers (fig. 31*b*). With or without dorsal cirri on setiger 2. . . **E. verugera**

   Median antenna longer than the lateral antennae, reaching a little beyond the middle of the palps (fig. 35*d*) 2

2. Anterior parapodia with setae of 3 kinds: simple curved upper one, compound spinigers, compound falcigers. With dorsal cirri on setiger 2 . . . . **E. dispar**

   Anterior parapodia with all setae compound, with short appendages (fig. 31*e*). Dorsal cirri lacking on setiger 2 . . . . **E. hebes**

Exogone verugera (Claparède, 1868)

FIGURE 31,*a–d*

Paedophylax brevicornis Webster and Benedict, 1887, p. 721, pl. 2, figs. 40–41, pl. 3, figs. 42–45.

Exogone verugera Fauvel, 1923, p. 307, figs. 117,*m–r*.—Annenkova, 1938, p. 155.—Berkeley and Berkeley, 1948, p. 78, fig. 116.—Wesenberg-Lund, 1950a, p. 16; 1950b, p. 49.—Day, 1953, p. 418; 1960, p. 317.—Eliason, 1962, p. 246.

DESCRIPTION.—Length up to 8 mm., width up to 0.3 mm., segments 35–50. Prostomium with 4 eyes (sometimes 6, an additional small anterior pair near the bases of the palps); palps usually with a well marked notch anteriorly (fig. 31*a*). Neurosetae (fig. 31,*b–d*) of 3 kinds: Single upper simple curved one; 1–3 upper compound, with appendages tapering to capillary tips; 2–6 compound, with appendages short, curved. Colorless. Male and female epitokes with long swimming setae beginning on about setiger 18 (13–18, Wesenberg-Lund).

BIOLOGY.—Found at low water in sand, mud, among bryozoans and alage. Dredged on bottoms of fine to coarse sand, muddy sand, gravel, rocks, stones, and shells.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Gaspé Bay, Laurentian Channel), Maine (Woodbridge Island, Sheepscot River), Massachusetts (Georges Bank; Massachusetts Bay off Plymouth; Cape Cod Bay; south of Martha's Vineyard), low water to 87 fathoms.

DISTRIBUTION.—West Greenland, Faroes, Danish waters, Madeira, Mediterranean, Gulf of St. Lawrence to Massachusetts, west coast Vancouver Island, Mexico, north Japan Sea to Japan, Australia, South Africa. In low water to 87 fathoms; sexual epitokes in surface waters.

***Exogone dispar* (Webster, 1879)**

FIGURE 35*d*

Paedophylax dispar Webster, 1879, p. 223, pl. 4, fig. 49, pl. 5, figs. 50–55; 1886, p. 138.—Sumner, Osburn, and Cole, 1913, p. 615.—Miner, 1950, p. 299, pl. 98.

Paedophylax longiceps Verrill, 1879, p. 170; 1881, p. 320, pl. 12, fig. 2.—Miner, 1950, p. 299, pl. 98.

Paedophylax longicirris Webster and Benedict, 1887, p. 722, pl. 3, figs. 46–50.

Sphaerosyllis fortuita Treadwell, *in* Cowles, 1930, p. 342.—Not Webster, 1879.

Exogone dispar Hartman, 1944a, p. 338, pl. 24, fig. 9, pl. 25, fig. 5; 1945, p. 16, pl. 2, figs. 7, 9, 10; 1951, p. 40.—Pettibone, 1954, p. 259, fig. 28*k*.

DESCRIPTION.—Length up to 8 mm., width up to 0.5 mm., segments 20–45. Prostomium with 4 eyes with lenses; palps bluntly rounded anteriorly or with slight anterior notch (fig. 35*d*). Neurosetae of 3 kinds: Single upper simple, slightly curved one; 1–2 upper compound, with appendages tapering to capillary tips; 3–4 compound, with appendages short, curved. Colorless or white with slightly reddish tinge. Male and female epitokes with long swimming setae beginning on about setiger 12 (6–15), continuing up to last few segments. The females, with large purplish eggs or young attached to body, may lack the swimming setae.

BIOLOGY.—Found at low water, under rocks, in mussel beds, among debris, in algal masses, on tubes of *Diopatra cuprea*, on pilings, on hydroids (as *Pennaria*), in water-soaked wood. Dredged on bottoms of stones, gravel, rocks, shells, bryozoan nodules, among tunicates (as sandy *Amaroecium pellucidum*). They may secrete a mucous sheath. In the Woods Hole region, male epitokes with swimming setae have been found at the surface in the evening in June (June 8, 1954); males and females with swimming setae, as well as females with eggs and embryos attached, have been dredged in June (June 14 and 24, 1954). Mature epitokes are found swimming actively at the surface throughout July and August but are even more plentiful on mussel beds, where exclusively brooding females, after loss of capillary setae, are found (Moore, MS.).

MATERIAL EXAMINED.—Numerous specimens from Maine (Boothbay Harbor region), Massachusetts (Woods Hole region, Vineyard Sound, 13–35 fathoms), New Jersey (Raritan Bay), Virginia (Chincoteague Bay near Robins Marsh; Chesapeake Bay, *Fish Hawk* Station 8834).

DISTRIBUTION.—Arctic Alaska to Mexico, Maine to southern Florida. Low water to 70 fathoms; sexual epitokes at surface.

Exogone hebes **(Webster and Benedict, 1884)**

FIGURE 31,*c*,*f*

Paedophylax hebes Webster and Benedict, 1884, p. 716, pl. 3, figs. 31–36; 1887, p. 721.—Miner, 1950, p. 299.

Exogone hebes Fauvel, 1923, p. 308, fig. 118,*g–p;* 1936b, p. 32.—Wesenberg-Lund, 1950a, p. 17; 1950b, p. 49.—Berkeley and Berkeley, 1954, p. 459.—Eliason, 1962, p. 246.

DESCRIPTION.—Length up to 10 mm., width up to 0.4 mm., segments 30–45. Prostomium with 4 large eyes and usually with an additional smaller pair near the bases of the palps; palps rounded anteriorly, without any anterior indentation. Neurosetae of anterior parapodia all compound, with short hooked appendages (fig. 31*c*); at about the middle third of the body, with an additional straight, simple, pointed upper seta (fig. 31*f*). Body gray, creamy white or golden yellow. Male and female epitokes with swimming setae beginning on about setiger 11 (Wesenberg-Lund).

BIOLOGY.—Found at low water in sand, gravelly sand, sandy mud, in sand around roots of eelgrass, *Zostera*. Dredged on bottoms of medium to coarse sand and shell, and gravel.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Prince Edward Island), Maine (Hendricks Head Beach, Southport Island; Waites Landing, Falmouth Foreside, Casco Bay), Massachusetts (Georges Bank, 18–47 fathoms; Provincetown).

DISTRIBUTION.—West Greenland, Ireland, Denmark, English Channel, Morocco, Gulf of St. Lawrence to Massachusetts. Low water to 78 fathoms.

Genus *Parapionosyllis* Fauvel, 1923

Type (designated by Hartman, 1959a, p. 215): *Parapionosyllis gestans* (Pierantoni, 1903). Contains only one New England species.

Parapionosyllis longicirrata (Webster and Benedict, 1884)

FIGURE 35,*e*,*f*

Sphaerosyllis longicirrata Webster and Benedict, 1884, p. 715, pl. 8, figs. 95–100.—Miner, 1950, p. 293, pl. 96.
?*Parapionosyllis minuta* Fauvel, 1923, p. 292, fig. 111*f*.

DESCRIPTION.—Length up to 5 mm., width up to 0.3 mm., segments up to 40. Body tiny, threadlike, of fairly uniform width, without surface papillae. Prostomium suboval, wider than long, with 2 pairs larger eyes on posterior half and a pair of minute ocular spots near the lateral antennae. Median antenna attached posteriorly on prostomium and extending a little beyond the palps. Lateral antennae attached anteriorly, slightly shorter than the median antenna. Palps large, basal third fused, distal part may be extended anteriorly or partially flopped ventrally. Single pair tentacular cirri similar to lateral antennae. Parapodia stout, cylindrical, truncate distally, with knobbed acicula. Neurosetae of 2 kinds: Single upper simple seta, beveled at tip; compound setae with shorter to longer appendages, with tips entire, slightly hooked. Dorsal cirri subulate, wider basally, tapering to more slender distal tips, extending slightly beyond the setae, present on all setigers including setiger 2. Ventral cirri digitiform, as long as setal lobe. Anal cirri similar to antennae.

Proboscis with a single anterior tooth. Body colorless. Male epitokes with capillary setae beginning on setiger 11, continuing up to last few segments. Females with a single large egg per segment in setigers 11–28; eggs and embryos attached ventrally to body of female, 1 per segment; they develop to an advanced stage up to 5 setigers and the beginning of a sixth, similar to adult, including the shape of the head (the 6 eyes have the same arrangement but they are subequal in size), setae, etc. Dorsal cirri are lacking on setiger 2 (differs thus from the adult). The young are attached by the posterior end between the paired anal cirri.

BIOLOGY.—Found at low water, in muddy sand, on shells, and among tubes of small maldanids. Dredged on bottoms of mud. Females with large developing eggs were found in October (October 20, 1956, Buzzards Bay, N. Riser).

MATERIAL EXAMINED.—Massachusetts (Orleans, Provincetown on Cape Cod; Woods Hole region, Lackey's Bay, Hadley Harbor, West Falmouth Harbor, Buzzards Bay, low water to 10 fathoms).

DISTRIBUTION.—Massachusetts. Gulf of Naples?. Low water to 10 fathoms.

Genus *Brania* Quatrefages, 1866

Grubea Quatrefages, 1866, preoccupied by Diesing (1858, Vermes, Trematoda). Type (herein designated): *Grubea clavata* (Claparède, 1863).

Grubiosyllis Verrill, 1900; new name for *Grubea* Quatrefages, preoccupied.

Type (monotypy): *Brania pusilla* (Dujardin, 1851).

Both species are tiny, slender, threadlike, cylindrical. Prostomium suboval, wider than long; median antenna attached posteriorly between posterior pair of eyes; lateral antenna anterior on prostomium; palps large and prominent, fused basally, more or less free distally. Tentacular segment more or less distinct, with 2 pairs tentacular cirri similar to antennae. Antennae and dorsal cirri subulate, wider basally, tapering to more slender tips; dorsal cirri extending slightly beyond the setal tips. Ventral cirri digitiform, extending about to tips of setal lobes.

Key to the New England Species of *Brania*

1. Parapodia with compound setae with distal blades shorter to longer, with tips finely bidentate. Prostomium with a pair of small ocular spots near the lateral antennae in addition to the four larger eyes (fig. 35*b*). With dorsal cirri on setiger 2 . . . . **B. clavata**

Parapodia with compound setae with distal blades short, subequal, with tips entire (fig. 35*h*). Prostomium without ocular spots. Without dorsal cirri on setiger 2 . . . . **B. wellfleetensis**

Brania clavata (Claparède, 1863)

FIGURE 35*b*

Grubea dolichopoda Webster, 1879, p. 110; 1886, p. 138.—Webster and Benedict, 1884, p. 713.

Grubea websteri Verrill, 1882, p. 370.

Grubiosyllis websteri Sumner, Osburn, and Cole, 1913, p. 615.

Grubea clavata Southern, 1914, p. 22.—Fauvel, 1923, p. 296, fig. 114,*a-e*.—Annenkova, 1938, p. 153.—Day, 1954, p. 12.—Uschakov, 1955, p. 189, fig. 56.—Wesenberg-Lund, 1958, p. 7.

Brania clavata Rioja, 1943, p. 215, figs. 7–11, 31.—Hartman, 1944a, p. 338, pl. 24, figs. 5–8, pl. 25, fig. 2.—Banse, 1959, p. 433.

DESCRIPTION.—Length up to 4 mm., width up to 0.3 mm., segments 21 to 35. Prostomium with 2 pairs of eyes, anterior lateral pair larger with large lenses; an additional minute pair of ocular spots near the lateral antennae; palps fused nearly to the obtuse rounded tips, grooved ventrally. Upper pair tentacular cirri about same length as the median antenna, lower pair about half as long (may easily be overlooked). Parapodia with setae of 2 kinds: Upper simple pointed one; compound setae with distal blades shorter to longer, finely bidentate, slightly hooked; posterior segments with upper and lower simple setae. Anal cirri 2, fusiform, may be longer than dorsal cirri.

Proboscis reddish, provided with anterior tooth. Colorless or may have thin transverse brown bands on some segments connecting 2 dark spots; eyes dark reddish brown to orange. Male epitokes with capillary setae beginning usually on setiger 9 (9–10), continuing up to last few segments; females with or without swimming setae, with large white yolky eggs beginning in setiger 9, eggs 2 to 4 per segment; eggs and young attached to dorsal body of female on setigers 9–24 or so, 2 to 4 per segment, appearing crowded, compact and nearly covering the dorsum.

Biology.—Found at low water on mud flats, on stones, shells, mussel beds, among algae including holdfasts of *Laminaria*, on pilings among sponges, hydroids, tunicates, mussels, algae. Dredged on shelly and gravelly bottoms with bryozoan nodules, tunicates (as sandy *Amaroecium pellucidum*). It is found in salt ponds (Charlestown Pond, Rhode Island). In the Woods Hole region, males with swimming setae and females with eggs or embryos on the surface have been found in July to September; they may appear in the surface plankton in the evening. In Ireland, mature males with swimming setae were found from May to September (Southern, 1914).

Material examined.—Gulf of St. Lawrence (St. Lawrence estuary), Massachusetts (Woods Hole region, Martha's Vineyard, Cuttyhunk, Sandwich on Cape Cod, Lackey's Bay, Nonamesset Island, Vineyard Sound, low water to 13 fathoms), Rhode Island (Charlestown Pond, bottom tow, H. P. Jeffries), Delaware (Sand Cove, Assanoman Bay), Maryland (Public Landing).

Distribution.—Ireland, English Channel, France, Madeira, Mediterranean, South Georgia, Tristan da Cunha, Gulf of St. Lawrence to Maryland, Caribbean Sea, north Japan Sea, Mexico. In low water to 15 fathoms; sexual epitokes at surface.

Brania wellfleetensis Pettibone, 1956b

Figure 35*h*

Brania wellfleetensis Pettibone, 1956b, p. 282, fig. 2.

Description.—Length up to 7 mm., width up to 0.4 mm., segments up to 39. Prostomium with 2 pairs of eyes, anterior pair larger, more lateral, without ocular spots (rarely eyes missing?); palps fused on basal third; distal part may be extended anteriorly and be extremely long or somewhat contracted. Tentacular cirri subequal, similar to median antenna. Parapodia usually with setae all compound except in 6 or so posterior segments where there are simple upper and lower setae; with or without single simple seta in more anterior segments; compound setae with appendages rather short, subequal, with tips entire, hooked (fig. 35*h*). Anal cirri 3, a shorter median ventral one and a longer lateral pair. Proboscis with an anterior tooth. Colorless. Females with large eggs, one per segment, attached ventrally on setigers 14 to 29 or so.

BIOLOGY.—Found at low water, in muddy-sandy flats and on *Diopatra* tubes. Dredged on muddy bottom. Females with eggs attached to body were found in October (Buzzards Bay, 10 fathoms, October 20, 1956, N. Riser).

MATERIAL EXAMINED.—Massachusetts (Wellfleet Harbor, Cape Cod; Chappaquoit; Buzzards Bay, 10 fathoms, N. Riser).

DISTRIBUTION.—Massachusetts. Low water to 10 fathoms.

Genus *Sphaerosyllis* Claparède, 1863

Type (designated by Hartman, 1959a, p. 222): *Sphaerosyllis hystrix* Claparède, 1863.

Both species are tiny, threadlike, with body linear, tapering slightly anteriorly and posteriorly, oval in cross section. Body, including parapodia, covered with small papillae and incrusted with fine granular material. Prostomium subrectangular, much wider than long. Antennae subequal, bulbous basally, narrower distally; median antenna attached posteriorly on prostomium, lateral antennae anterior in position; palps fused basally.

Tentacular segment not distinctly set off from the prostomium (the prostomium may be pulled back within the tentacular segment so that the single pair of tentacular cirri may appear to be anterior to or on the same level with the median antenna); tentacular cirri similar to the antennae. Neurosetae of 2 kinds: Single, long, simple tapering upper one; compound setae with distal blades entire, hooked. Dorsal cirri similar to the antennae, lacking on setiger 2. Ventral cirri digitiform, shorter than the setal lobes. Anal cirri 2, larger than the dorsal cirri. Proboscis with a single anterior tooth.

Key to the New England Species of *Sphaerosyllis*

1. Prostomium with 6 eyes—2 larger pairs in transverse line or slightly concave arc and 2 small anterior ocular spots (fig. 35*a*). Parapodia without capsules of rodlike structure . . . . **S. erinaceus**

Prostomium with 4 eyes in rectangular arrangement. Basal part of parapodia with rounded capsules filled with small rods, beginning on setiger 4 (fig. 35*g*) . . . . **S. hystrix**

Sphaerosyllis erinaceus Claparède, 1863

FIGURE 35*a*

Sphaerosyllis brevifrons Webster and Benedict, 1884, p. 714, pl. 3, figs. 24–30; 1887, p. 720.—Miner, 1950, p. 292, pl. 96.

Sphaerosyllis longicauda Webster and Benedict, 1887, p. 720, pl. 3, figs. 35–39.

Brania sp. Hartman, 1944a, pl. 24, figs. 1–2.

Sphaerosyllis erinaceus Pettibone, 1954, p. 255, fig. 28*m*; 1956a, p. 555.—? Day, 1954, p. 13, fig. 2,*e–g*.—Uschakov, 1955, p. 190, fig. 55.—Banse, 1959, p. 434.

Description.—Length up to 4.5 mm., width up to 0.5 mm., segments 22–37. Prostomium with palps short, wide, rounded anteriorly; palps may project more anteriorly, extending about the same length as the prostomium, with basal halves fused and distal halves separated by a narrow groove or they may project more ventrally, extending only about half the length of the prostomium and appear to be fused except for a small anterior indentation. Dorsal cirri short, slightly longer than the parapodial lobes and shorter than the setae, inflated basally, tapering to narrow tips. Colorless.

Form sexual epitokes. Male epitokes with swimming setae beginning on setiger 8. Females with or without swimming setae, with large yolky eggs and larvae attached to dorsal part of the parapodial bases, 1 to 4 per segment, beginning on about setiger 8 (8–9). Eggs may be compact, crowded, and also covered with mud, as is the body of the female.

Biology.—Found at low water, in sand, under rocks, on sponges, on pilings among sponges, tunicates, etc. Dredged on bottoms of stones, gravel, rocks, with shells, hydroids, bryozoans, tunicates (as sandy *Amaroecium pellucidum*). A single specimen was found in the oceanographic fouling studies in the New England region. In the Woods Hole region, males with swimming setae and females with eggs and young attached have been found in June to September; in the Chincoteague Bay region, Virginia, in May; in Ireland region, in July (Southern, 1914), in Arctic Alaska, in September and October (Pettibone, 1954).

Material examined.—Massachusetts (Woods Hole region, Fisheries Dock, evening, June 8, 1954; Juniper Point; Hadley Harbor; Martha's Vineyard; Vineyard Sound, 13 fathoms), Virginia (Chincoteague Bay near Robins Marsh).

Distribution.—Widely distributed in the Arctic. Also Iceland, Denmark, English Channel and the Baltic, Mediterranean, Labrador to Virginia, Bering Sea, north Japan Sea, Mexico (?), Tristan da Cunha (?). Low water to 75.5 fathoms; sexual forms at surface.

Sphaerosyllis hystrix Claparède, 1863

Figure 35*g*

Sphaerosyllis brevifrons Webster and Benedict, 1884, p. 714 (part; from South Norwalk, Connecticut).

Sphaerosyllis hystrix Southern, 1914, p. 19.—Fauvel, 1923, p. 301, fig. 115,*g–k*.—Berkeley and Berkeley, 1948, p. 80, fig. 119.—Banse, 1959, p. 433.

Description.—Length up to 5 mm., width up to 0.3 mm., segments 21 to 40. Palps fused, triangular, longer than the prostomium or they may be bent down ventrally when they appear to be short.

Dorsal cirri about length of setal lobes, basal portion globular, distal portion cylindrical (fig. 35*g*). Form sexual epitokes; male epitokes with swimming setae beginning on about setiger 7 (7–11); females with eggs and embryos attached ventrally to parapodia, 2 to 4 per segment, beginning on about setiger 7 (7–8).

BIOLOGY.—Found at low water in mud, on algae, sponges, shells, in *Laminaria* holdfasts. In Ireland region, mature specimens with swimming setae found from May to October (Southern, 1914).

MATERIAL EXAMINED.—Three slides of specimens identified as *S. brevifrons* by Webster and Benedict, presumably from South Norwalk, Connecticut.

DISTRIBUTION.—British Isles, France, Mediterranean, Black Sea, Connecticut, west coast Vancouver Island, Mexico. Low water to 16 fathoms.

Genus *Autolytus* Grube, 1850

Polybostrichus Oersted, 1843; type (monotypy): *Polybostrichus longosetosus* Oersted, 1843; = male stolon *Autolytus* sp.

Sacconereis M. Müller, 1855; type (monotypy): *Sacconereis helgolandica* M. Müller, 1855; = female stolon *Autolytus prolifer* (O. F. Müller, 1788b).

Proceraea Ehlers, 1864; type (monotypy): *Proceraea picta* Ehlers, 1864.

Stephanosyllis Claparède, 1864; type (monotypy): *Autolytus* (*Stephanosyllis*) *scapularis* Claparède, 1864; = *Autolytus pictus* (Ehlers, 1864).

Type (original designation): *Autolytus prolifer* (O. F. Müller, 1788b).

The species represented have the body of the stem form thin, elongate, widest anteriorly, attenuated posteriorly, flattened ventrally, arched dorsally. Prostomium (fig. 38,*a*,*b*) suboval, with palps poorly developed, fused, turned ventrally, forming a thin rim projecting a variable distance beyond the head, with 4 eyes in trapezoidal arrangement (may be an additional minute anterior pair near the bases of the palps). Antennae, tentacular cirri and first 1 or 2 pairs of dorsal cirri long, filiform, longer than the rest of the dorsal cirri, smooth or faintly annulate, often curled. Median antenna and first pair of dorsal cirri longest, lateral antennae and upper pair of tentacular cirri next in length, lower pair tentacular cirri shorter. Nuchal epaulettes or dorsal ciliated ridges more or less developed. Neuropodia short, bulbous, without ventral cirri (fig. 38*c*).

Proboscis rather long, more or less sinuous, with chitinous lining with a crown of teeth. Reproduction by stolons which differ from the stem form and are sexually dimorphic. Each species, then, has three types of individuals: Stem form which buds off asexually male or female stolons, singly (fig. 38*a*) or in chains (fig. 40*a*); male stolons or polybostrichus stage; female stolons or sacconereis stage.

Female stolons or sacconereis stage (fig. 39, 40*b*): Head suboval with 2 pairs of eyes, a larger ventral pair and a smaller dorsal pair, with 3 subequal antennae. Tentacular cirri 1–3 pairs. Body divided into 2–3 regions: anterior region with prenatatory unmodified setigers without swimming setae; middle region with natatory setigers in which the parapodia become more elongate, with long swimming setae developed in newly formed notopodia; and posterior region of unmodified setigers without swimming setae (the latter region may be nearly lacking). Neurosetae as in the stem form. Dorsal cirri rather long, subequal. Large yolky eggs found within the body or enclosed in a 1- to 3-lobed, delicate but durable, transparent ventral brood sac, the body of the female being coiled ventrally around it. The larvae pass through their early stages within the sac, developing 2 prominent anterior and posterior ciliated bands.

Male stolons or polybostrichus stage (figs. 37, *a–b; 40c*): Differ from the female stolons in that they have a pair of short frontal antennae, a very large median antenna, a pair of large forked palps, the inner fork usually thicker and curled. Tentacular cirri 2–3 pairs; usually 1 pair of tentacular cirri are very long and coiled, similar to the median antenna (in *A. alexandri*, the first pair of dorsal cirri are modified in this way). Body divided into 2–3 regions as in the female stolons; testes and sperm in prenatatory segments.

Key to the New England Species of *Autolytus*

1. Neurosetae simple, with bulbous tips, with or without hairlike tips (fig. 37*c*). Male and female stolons with 6 prenatatory setigers, 2 pairs tentacular cirri. (Known from sexual stolons only) . . . . **A. emertoni**

 Neurosetae compound, with stem inflated distally, with appendages short, curved, bidentate (fig. 38*e*), and a single upper simple bayonette seta (at least in posterior segments; fig. 38*d*) 2

2. Stem form with dorsal cirri short, subequal, about half the length of the body width (except anterior two pairs); sexual stolons produced singly, with head of stolon forming between setigers 13 and 14 (rarely between 12 and 13 or 14 and 15), the body of the stem form posterior to setiger 13 (12–14) developing into the sexual stolon (fig. 38*a*). Sexual stolons with 6 prenatatory setigers, 3 pairs of tentacular cirri and a pair of small achaetous knobs; in male stolon, first pair tentacular cirri similar to dorsal cirri with second pair at its ventral base, third pair very long and stout, similar to median antenna, with small achaetous knob at its ventral base (fig. 37, *a–b*); in female stolon, similar except both the first and third pairs are similar to the following dorsal cirri (fig. 39) 3

 Stem form with dorsal cirri longer, more than half the length of the body width; sexual buds formed at least posterior to segment 19 4

3. Body with 3 longitudinal light to dark black bands middorsal and dorsolateral at the level of the bases of the dorsal cirri (fig. 37*d*) . . . **A. prismaticus**

 Body with reddish brown transverse dorsal bands, 1 per segment, on every segment or at irregular intervals (fig. 38*a*) . . . . **A. fasciatus**

 Body colorless or with faint dusky dorsolateral longitudinal bands (fig. 37*e*). **A. cornutus**

4. Stem form with sexual buds formed in chains of 2 to 8 (rarely singly; fig. 40*a*). Sexual stolons with usually 3 prenatatory setigers (2–4 in female); usually 2 pairs tentacular cirri (1 or 2 pairs in female); in female stolon, tentacular cirri similar to the following dorsal cirri (fig. 40*b*); in male stolon, upper pair tentacular cirri very long, similar to median antenna (fig. 40*c*). **A. prolifer**

   Stem form with sexual buds formed singly (?). Sexual stolons with 14 prenatatory setigers (sometimes 13?); tentacular cirri 2 pairs; in male stolon, first pair dorsal cirri very long, similar to median antenna . . **A. alexandri**

Autolytus emertoni Verrill, 1881

FIGURE 37*c*

Autolytus emertoni Verrill, 1881, pl. 12, fig. 9 (figure only).—Sumner, Osburn, and Cole, 1913, p. 616.—Hartman, 1942b, p. 43, fig. 59.—Miner, 1950, p. 296, pl. 97.

DESCRIPTION.—Stem form unknown. Female stolon with 6 prenatatory, about 24–26 natatory, 16–43 postnatatory setigers; tentacular cirri 2 pairs, without nuchal epaulettes; dorsal cirri very short, especially anterior 6 pairs; egg sac single, elongated. Male stolon with 6 prenatatory, 26–35 natatory, 15–20 postnatatory setigers; tentacular cirri 2 pairs, upper pair long, similar to median antenna, lower pair shorter.

BIOLOGY.—Sexual stolons found in surface waters in June (June 11, 1953) in Gulf of St. Lawrence, in July (July 1952, J. Rankin) and during winter and spring (Sumner, 1913) in Massachusetts.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Bay of Chaleurs, 6 fathoms, June 11, 1953, female stolons), Massachusetts (Vineyard Sound, in plankton, female stolon with egg sac, July 1952, J. Rankin).

DISTRIBUTION.—Known only from sexual stolons. Gulf of St. Lawrence, Massachusetts (Salem, Vineyard Sound, vicinity Woods Hole). Surface waters to 6 fathoms.

Autolytus prismaticus (Fabricius, 1780)

FIGURE 37*d*

Proceraea gracilis Verrill, 1874a, p. 132, pl. 5, fig. 1.—Webster and Benedict, 1887, p. 723.

Autolytus longisetosus Baillie, 1946, p. 474.—Miner, 1950, p. 298, pl. 97.

Autolytus prismaticus Pettibone, 1954, p. 249, fig. 29*a–b*.—Grainger, 1954, p. 513.

DESCRIPTION.—Stem form length up to 26 mm., width up to 1 mm., segments up to 105; nuchal epaulettes short, rounded, may extend partly on first setiger; second pair dorsal cirri similar in length to lower pair tentacular cirri; body white, yellowish or pale greenish, with three conspicuous longitudinal dark brown or black bands; the middorsal band broader and less dense, continuing throughout the length of body, the dorsolateral bands at the level of the bases of the

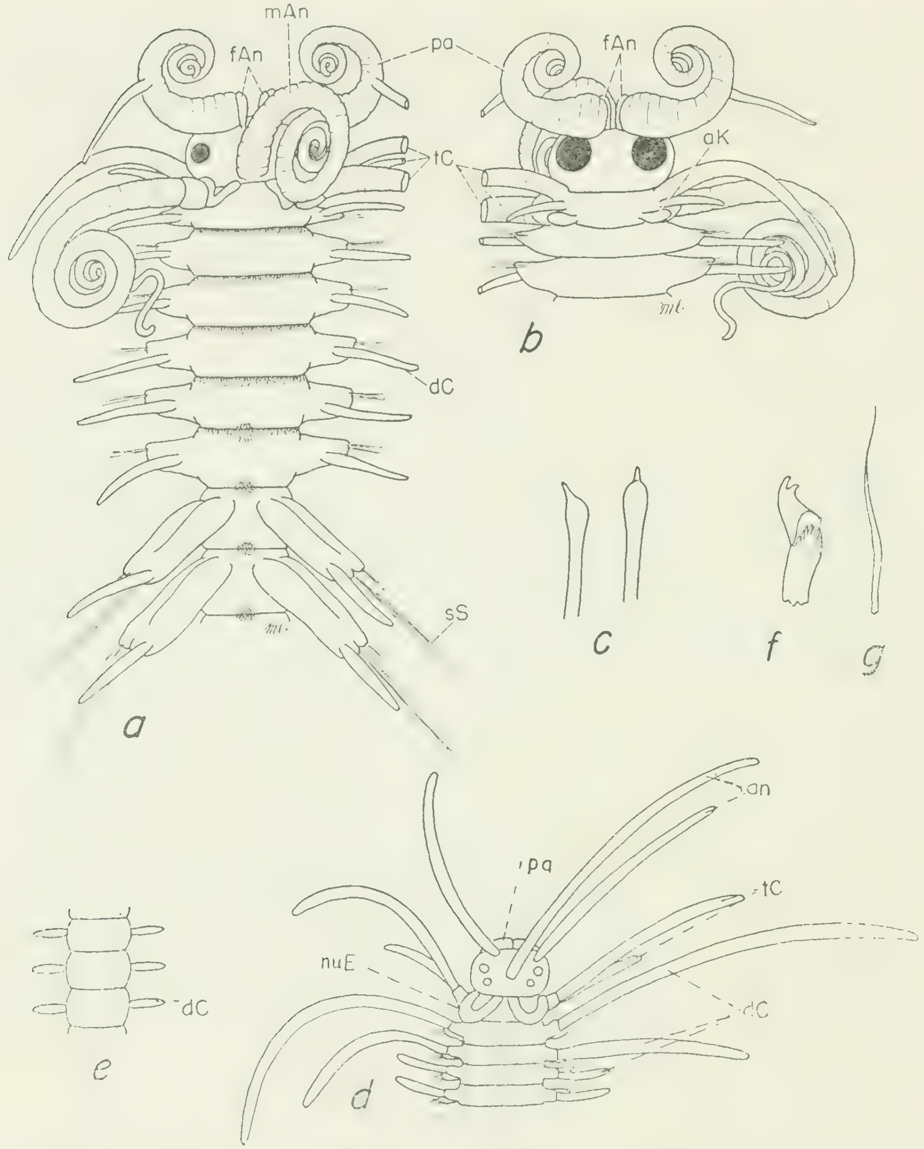

Figure 37.—Syllidae, *a–b*, *Autolytus fasciatus*, male stolon or polybostrichus stage: *a*, dorsal view anterior end; *b*, ventral view anterior end. *c*, *Autolytus emertoni*, neurosetae. *d*, *Autolytus prismaticus*, dorsal view anterior end. *e*, *Autolytus cornutus*, portion of body showing dorsolateral banding. *f–g*, *Autolytus alexandri* (after Moore, MS.): *f*, compound seta from setiger 10; *g*, simple seta from same.

dorsal cirri, narrower, darker, may be confined to anterior fourth or half of the body; tips of antennae, tentacular cirri, dorsal cirri, and epaulettes may be rusty brown.

Female stolon with 6 prenatatory, 18–31 natatory, 15–50 post-natatory setigers; nuchal epaulettes extending on first setiger; anterior region, at least, with same pigmented pattern as in stem form, three longitudinal bands or lateral bands may be missing; egg sac formed of a single lobe, with eggs coral pink. Male stolon with 6 prenatatory, 23–35 natatory, 21–30 postnatatory setigers.

BIOLOGY.—Found at low water in tide pools, under rocks in sponges, on pilings, among shells, sponges, hydroids, mussels, in holdfasts of algae (as *Laminaria*). Dredged on bottoms of mud, coarse sand, gravel, stones, with shells, sponges, algae. Stem form, with sexual buds forming, found in April, June, July (in Maine, Massachusetts); sexual stolons found in July and August (in Canadian Arctic, Grainger, 1954), in August (in Arctic Alaska, Pettibone, 1954), in June and August (Gulf of St. Lawrence), November (Maine, New Hampshire), and December (Georges Bank).

MATERIAL EXAMINED.—Gulf of St. Lawrence (Bay of Chaleurs, 6–30 fathoms), Maine (Machias Bay; Boothbay Harbor region; the Nubble, York; *Albatross* III, 41° 22′ N., 69° 17′ W., 56 fathoms, December 19, 1955, R. Wigley, female stolon), New Hampshire (Newcastle, Rye Harbor), Massachusetts (Georges Bank, Marblehead, Woods Hole region, Martha's Vineyard, dredged in Vineyard Sound).

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Labrador to Massachusetts, Bering Sea to British Columbia, north Japan Sea. In low water to 267 fathoms; sexual forms at surface.

Autolytus fasciatus (Bosc, 1802)

FIGURES 37,*a*,*b*; 38; 39

Nereis fasciata Bosc, 1802, p. 144, pl. 5, fig. 6.

Proceraea ornata Verrill, 1873a, p. 746.—Wilson, 1900, p. 351.—Mensch, 1900a, p. 270; 1900b, p. 89.

Not *Proceraea fasciata* Langerhans, 1879, p. 581.

Autolytus ornatus not Verrill, 1879, p. 170 (=*A. prolifer*).—Verrill, 1882, p. 367.—Not Sumner, Osburn, and Cole, 1913, p. 616 (=*A. prolifer*).—Hartman, 1942b, p. 43; 1945, p. 16.—Miner, 1950, p. 294, pl. 96.—Allen, 1957, p. 49.

Proceraea tardigrada Webster, 1879, p. 227.—Andrews, 1891a, p. 282.—Wilson, 1900, p. 351.—Mensch, 1900b, p. 89.

Proceraea? coerulea Webster, 1879, p. 230.

Autolytus longisetosus Hartman, 1944a, p. 338, pl. 13, fig. 1 (male stolon, with transverse brown bands).—Not Oersted, 1843.

Autolytus? alexandri Hartman, 1944a, p. 338, pl. 13, fig. 2 (female stolon, with brown bands, with 6 prenatatory setigers).—Not Malmgren, 1867.

DESCRIPTION.—Stem form (fig. 38) length up to 30 mm., width up to 1 mm., segments up to 100; nuchal epaulettes conspicuous, crescentic, extending on first setiger; second pair dorsal cirri similar to lower tentacular cirri; body white or pale yellowish, with wide reddish brown transverse bands, 1 per segment, on nearly every segment or on every second to fourth segment, usually with a spot of pigment on the ventral side of the neuropodia.

Female stolon (fig. 39) with 6 prenatatory, 19–24 natatory, and 38–48 postnatatory setigers; nuchal epaulettes somewhat triangular, extending on first setiger; pigmented pattern as in stem form, transverse reddish brown dorsal bands every 1 to 4 segments, with dark spots on the ventral sides of the parapodia; eggs carried in 3-lobed egg sac; eggs whitish, bright blue or purplish. Male stolon (fig. 37, *a*, *b*) with 6 prenatatory, 21–29 natatory, 13–53 postnatatory setigers; body light to dark reddish brown banded, as in stem form.

Biology.—Found at low water under stones, on pilings, among algae, hydroids, bryozoa. Dredged up to 18 fathoms on gravelly bottom, in sponges, on shells, among bryozoan nodules. Stem form, with sexual buds forming, may be found at any time of year but are especially abundant in June through August (Massachusetts); sexual

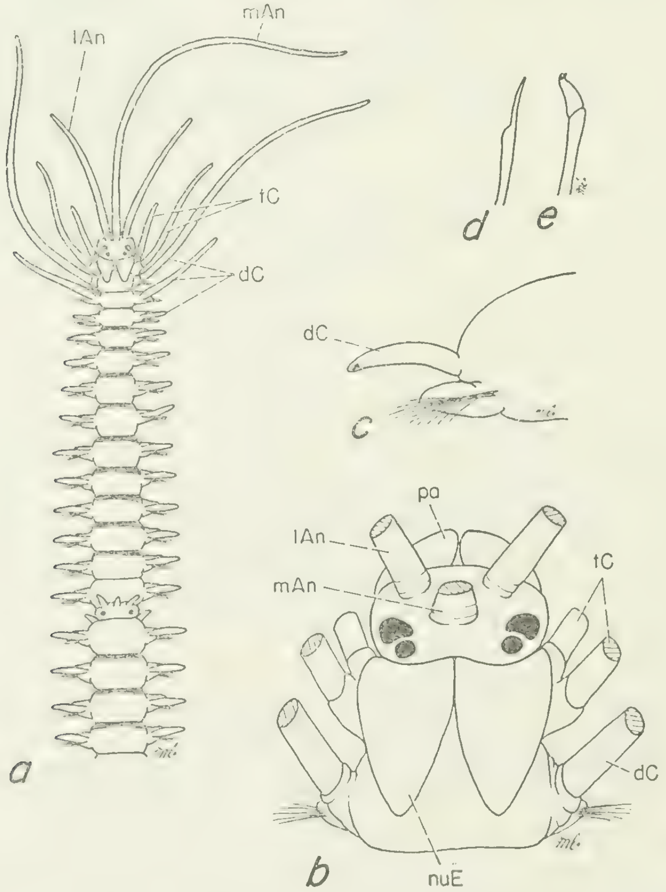

Figure 38.—Syllidae, *Autolytus fasciatus*, stem form with bud: *a*, dorsal view anterior end with head of sexual bud forming between setigers 13 and 14; *b*, dorsal view anterior end, with bases of antennae and cirri only shown; *c*, parapodium; *d*, neuroseta, simple bayonette; *e*, neuroseta, compound bidentate falciger.

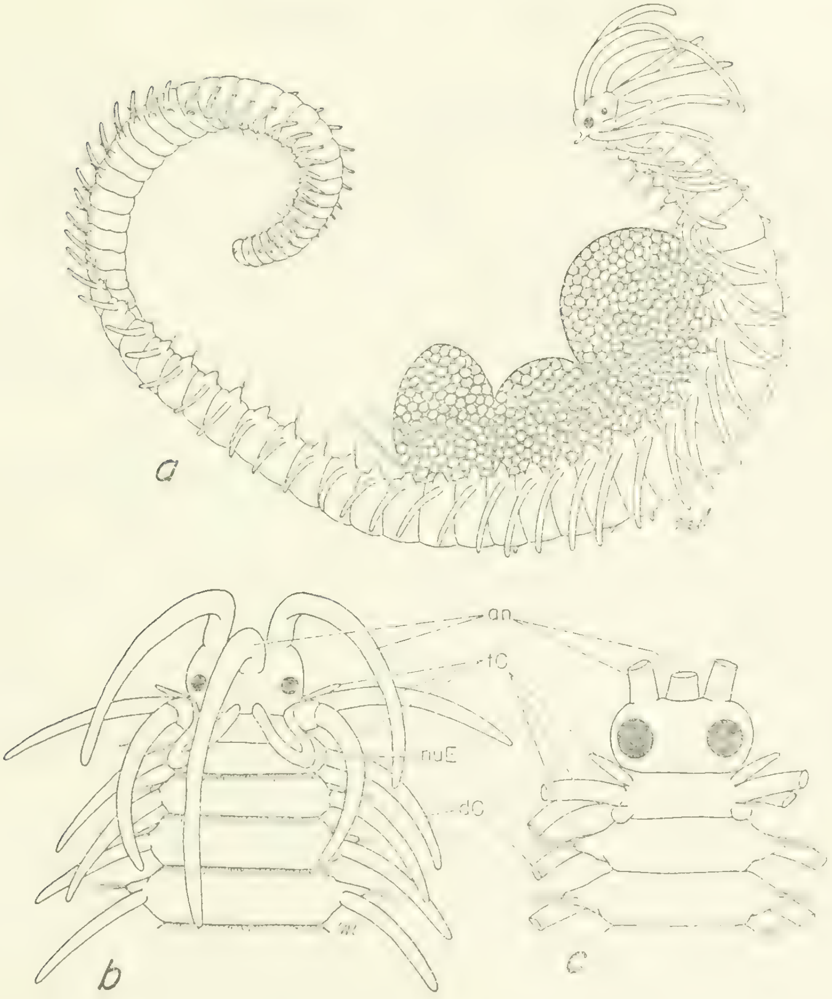

FIGURE 39.—Syllidae, *Autolytus fasciatus*, female stolon or sacconereis stage: *a*, lateral view, with 3-lobed egg sac; *b*, dorsal view anterior end; *c*, ventral view anterior end.

stolons found in surface waters in June to September (Massachusetts), in September (North Carolina, Wilson, 1900); according to Allen (1957), it breeds all the year round in Puerto Rico, being most abundant in May through July; the female stolons were collected most commonly, the male stolons appeared to be rare.

MATERIAL EXAMINED.—Massachusetts (Woods Hole region; Martha's Vineyard; Vineyard Sound, 13 fathoms), Puerto Rico (Magueyes, Parguera, female stolons with egg sacs, May 13, 1955; male stolons, July 26, 1955, and September 21, 1955, M. J. Allen).

DISTRIBUTION.—Massachusetts to South Carolina, Puerto Rico. Low water to 18 fathoms; sexual stolons at surface.

Autolytus cornutus Agassiz, 1863

Figure 37*e*

Autolytus cornutus Agassiz, 1863, p. 390, pls. 9–11.—Verrill and Smith, 1874, pp. 103, 296, pl. 13, figs. 65–66.—Verrill, 1881, pp. 292, 300, 304, 308, 323, pl. 12, figs. 4, 6.—Webster and Benedict, 1884, p. 717; 1887, p. 722.—Wilson, 1900, p. 351.—Mensch, 1900a, p. 270; 1900b, p. 89.—Sumner, Osburn, and Cole, 1913, p. 616.—Procter, 1933, p. 139.—Hartman, 1944a, p. 338, pl. 13, figs. 4–6.—Miner, 1950, p. 294, pl. 97.—Pratt, 1951, p. 329.

Autolytus hesperidum Webster 1886, p. 110.—Treadwell, *in* Cowles, 1930, p. 342.—Not Claparède, 1868.

Myriana cirrata Treadwell, *in* Cowles, 1930, p. 342.—Treadwell, 1931, p. 2, fig. 2.

Autolytus prismaticus Berkeley and Berkeley, 1948, p. 68, figs. 97–99.—Not Fabricius, 1780.

Autolytus fallax Pettibone, 1954, p. 247, fig. 29, *c–f;* 1956, p. 555.

Description.—Stem form length up to 18 mm., width up to 0.7 mm., segments up to 78; nuchal epaulettes lacking or short, shallow; second pair dorsal cirri only slightly longer than following; body flesh colored, may be tinged with green or dusky around basal parts of parapodia forming faint lateral brownish bands.

Female stolon with 6 prenatatory, 12–18 natatory, 3–27 postnatatory setigers; nuchal epaulettes inconspicuous; eggs in single ventral egg sac, with eggs pale greenish. Male stolons with 6 prenatatory, 17–30 natatory, 0–10 postnatatory setigers; five pairs testes in setigers 2–6 (Moore, ms.); body colorless or brownish.

Biology.—Found at low water under rocks, on pilings, in muddy sand, with algae (as *Laminaria*), sponges, hydroids, barnacles, mussels, as *Mytilus.* They construct cylindrical tubes attached to algae, branches of hydroids, etc.; they may leave their tubes and return to them. They are dredged up to 25 fathoms on bottoms of mud, sand, with stones, rocks, shells, among tunicates (as sandy *Amaroecium*). Numerous specimens were obtained in the oceanographic fouling studies from the New England region. Stem forms with sexual buds forming are found at any time of year and are especially abundant in June to August (Maine, Massachusetts); sexual stolons have been found in June, July, and August (Gulf of St. Lawrence, Maine, Massachusetts), in August and September (North Carolina, Wilson, 1900), in September, October, February to May in the Arctic (Point Barrow, Pettibone, 1954).

Material examined.—Gulf of St. Lawrence (Bay of Chaleurs, St. Lawrence estuary), Newfoundland, Maine (Gulf of Maine; Boothbay Harbor region; the Nubble, York), New Hampshire (Rye Harbor, Hampton Harbor), Massachusetts (Marblehead; Sandwich and Wellfleet on Cape Cod; Martha's Vineyard; Vineyard Sound, 25 fathoms), Rhode Island.

Distribution.—Arctic, Labrador to Chesapeake Bay. In low water to 75 fathoms; sexual stolons in surface waters.

Autolytus prolifer (O. F. Müller, 1788b)

FIGURE 40

Autolytus ornatus Verrill, 1879, p. 170.—Not *Proceraea ornata* Verrill, 1873a.

Autolytus varians (new name for *A. ornatus*, preoccupied) Verrill, 1881, p. 320, pl. 12, fig. 8; 1882, p. 367.—Andrews, 1891a, p. 282.—Mensch, 1900a, p. 269, pls. 13–14; 1900b, p. 89.—Sumner, Osburn, and Cole, 1913, p. 615.—Hartman, 1942b, p. 44, figs. 57–58; 1944a, p. 338, pl. 13, figs. 3, 7–10, pl. 25, fig. 3; 1945, p. 16.—Miner, 1950, p. 296, pl. 97.—Pratt, 1951, p. 329, fig. 451.

Autolytus mirabilis Verrill, 1882, p. 367.

Autolytus solitarius Webster and Benedict, 1887, p. 722, pl. 2, fig. 51, pl. 4, figs. 52–54.—Treadwell, *in* Cowles, 1930, p. 342.

Autolytus prolifer Southern, 1914, p. 43.—Fauvel, 1923, p. 311, fig. 119.—Thorson, 1946, p. 38, figs. 10–11.—Newell, 1954, p. 333.—Day, 1957, p. 75; 1960, p. 318.—Banse, 1959, p. 435.—Clark, 1960, p. 18.

Autolytus prolifera Hartman, 1959a, p. 200.

DESCRIPTION.—Stem form (fig. 40*a*) length up to 20 mm., segments up to 70; nuchal epaulettes rather inconspicuous, may extend on setigers 3–4; second pair dorsal cirri similar in length to the following; rest of dorsal cirri variable in length, some as long as the body width; styles of dorsal cirri often appear to be divided into two segments, a longer basal segment or basal cirrophore and a shorter distal one; body pale, translucent, yellowish or peach colored, may be transversely banded with 2 narrow bands per segment, consisting of orange-yellow to bluish grey granulations which may extend also in the cirrophores of dorsal cirri; a transverse ciliated band continuing on the basal part of the dorsal cirri.

Sexual buds produced in unisexual chains of 2 to 8 (females up to 6 in a chain, males up to 8 in a chain). The parapodia of most of the body become enlarged, massed with developing sex products. Stolons formed by a proliferation of cells from a few segments, forming crowded segments which gradually enlarge. The sexual buds are proliferated posteriorly from the stem at a variable region usually after setigers 32–38 (range of 19–65).

First a terminal bud is formed and while it is maturing, young stolons may be forming subterminally, forming chains of 2–8 or more. The terminal bud may become completely developed with head appendages fully formed, swimming setae formed, and body filled with sex products. It may wiggle vigorously and lift itself from the bottom, contrasting greatly with the crawling stem form to which it is attached.

Female stolons (fig. 40*b*) with 2–4 prenatatory, 11–27 natatory, 1–6 postnatatory setigers; nuchal epaulettes inconspicuous; body colorless or pale yellow; egg sac a single large sac which may be somewhat pinched in the middle, with eggs tan, orange, or bright red. Male stolons (fig. 40*c*) with 3 prenatatory, 17–25 natatory,

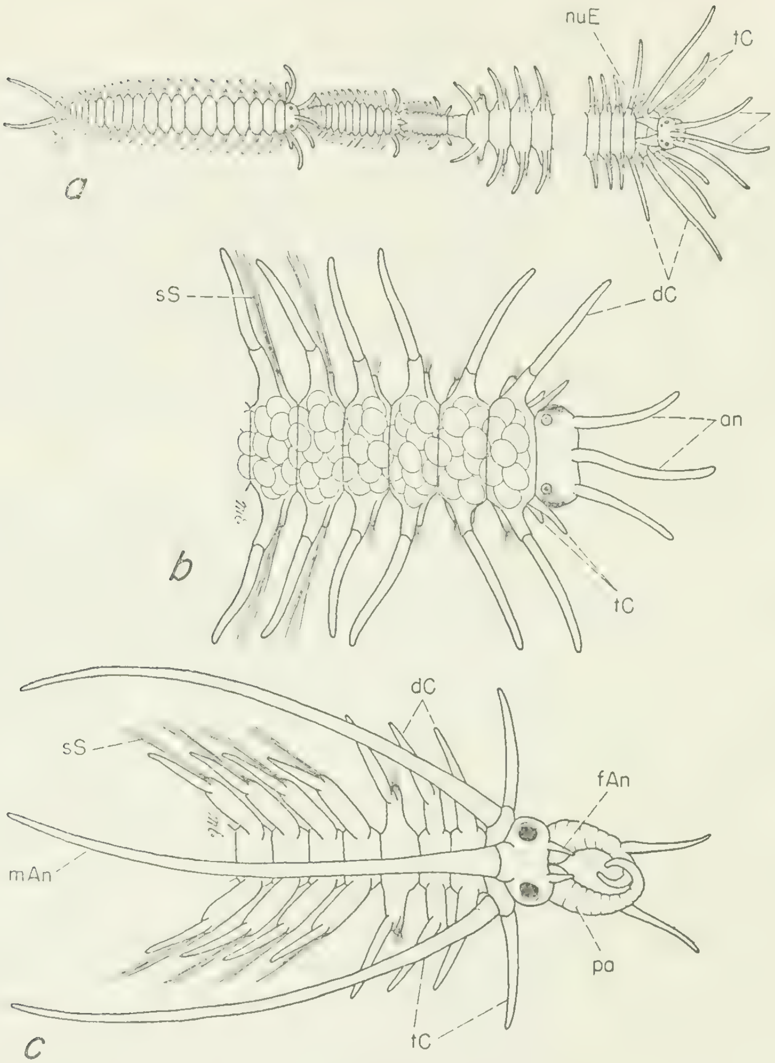

FIGURE 40.—Syllidae, *Autolytus prolifer: a*, dorsal view anterior and posterior ends, with chain of female sexual buds; *b*, dorsal view anterior end of female stolon or sacconereis stage, massed with eggs; *c*, dorsal view anterior end of male stolon or polybostrichus stage.

0–2 postnatatory setigers; body brownish red or green (for details of chain formation of stolons, see Mensch, 1900a).

BIOLOGY.—Found at low water among stones, algal clumps, holdfasts of *Laminaria*, on pilings among hydroids, bryozoans, ascidians. They form tough tubes. Dredged down to 15 fathoms, on gravelly bottoms, with shells, among algae, bryozoan nodules, tunicates (as sandy *Amaroccium*). They were present in the oceanographic fouling studies in the New England region. Stem forms in the process of forming sexual stolons are found at any time of year but are especially abundant in June through August (Massachusetts), in August (Maine); sexual stolons in surface waters have been found in June to October; sexual forms are common in inshore plankton in late spring and early summer in British Isles (Whitstable, Newell, 1954).

MATERIAL EXAMINED.—Gulf of St. Lawrence (off Cape Bon Ami, 30 fathoms), Maine (Gulf of Maine; Muscongus Bay near Hog Island, 2 fathoms), Massachusetts (Woods Hole region; Martha's Vineyard; Sandwich, Cape Cod; Hadley Harbor, Naushon Island; Vineyard Sound, 13 fathoms), Rhode Island (Narragansett Bay), Maryland (Rum Harbor, Chincoteague Bay), North Carolina (Beaufort), Georgia (Sapelo Island).

DISTRIBUTION.—Norway to France, Madeira, Mediterranean, South Africa, Gulf of St. Lawrence to Georgia. Low water to 30 fathoms; sexual stolons at surface.

Autolytus alexandri Malmgren, 1867

FIGURE 37,*f*,*g*

Stephanosyllis ornata Verrill, 1874a, p. 132, pl. 4, fig. 1.

Autolytus alexandri Verrill, 1881, p. 292, pl. 12, fig. 8.—Hartman, 1942b, p. 13; 1944a, p. 338, pl. 13, fig. 11; 1945, p. 17, pl. 2, fig. 11.—Miner, 1950, p. 294, pl. 96.—Pettibone, 1954, p. 246; 1956a, p. 555.

Proceraea (*Stephanosyllis*) *ornata* Webster and Benedict, 1887, p. 724.

Autolytus verrilli Grainger, 1954, p. 513.—Berkeley and Berkeley, 1956a, p. 236.

DESCRIPTION.—Stem form length up to 18 mm., width up to 0.8 mm., segments up to 82; nuchal epaulettes conspicuous, lanceolate, extending posteriorly on setigers 2–4; a second pair dorsal cirri about as long as lateral antennae and upper pair tentacular cirri, rest of dorsal cirri rather irregular in length, longer and shorter, some as long as or longer than body width; body colorless or transversely banded with reddish to brownish granules, may be 2 bands per segment, with dorsal ciliated transverse bands; sexual buds produced singly (?), with head forming between setigers 25 and 26 (according to Hartman, 1945).

Female stolon with 14 prenatatory, 18–30 natatory, 10–63 postnatatory setigers; nuchal epaulettes on first 3 setigers; eggs in 2-lobed egg sac. Male stolon with 14 prenatatory, 27–37 natatory, 11–23 postnatatory setigers; 4 pairs of testes in setigers 10–13 (Moore, MS.).

BIOLOGY.—Found at low water in tide pools, on pile scrapings among large barnacles. Dredged on bottoms of mud, sand, gravel, stones, rocks, with algae, sponges, bryozoans, hydroids, ascidians (as sandy *Amaroecium*), worm tubes, and shells. Sexual stolons found at surface in March and April (Massachusetts), in June (Gulf of St. Lawrence, June 27, 1953, June 1, 1954), in June to August (Canadian Arctic, Grainger, 1954).

Material examined.—Maine (between Barter and Hodgdon Islands, Boothbay Harbor region), Massachusetts (Georges Bank; Vineyard Sound; off Ram Island, Woods Hole, April 6 and 12, 1883, V. N. Edwards, male stolon at surface; Eel Pond, Woods Hole, female stolon with egg sac, at surface, March 3, 1956, M. Gray).

Distribution.—Scattered records in the Arctic. Also Iceland, Labrador to North Carolina, Bering Sea to Washington. Low water to 123.5 fathoms; sexual forms at surface.

Family Nereidae (=Lycoridae)

Body usually elongate, cylindrical, attenuated posteriorly. Prostomium distinct, suboval to subpyriform, with 4 eyes (rarely absent), 2 frontal antennae, 2 biarticulated palps (fig. 45*a*). First or tentacular segment usually apodous and achaetous; tentacular cirri usually 4 pairs (rarely 3 pairs, as in *Lycastopsis*). Except for the first 2 setigers, parapodia usually biramous (uniramous in some, as *Lycastopsis*), with dorsal and ventral cirri, with varying degrees of development of extra tonguelike extensions or ligules. Setae usually compound spinigers and falcigers. Pygidium with pair of anal cirri.

Proboscis (fig. 45,*c-e*) strong, muscular, eversible, differentiated into oral (proximal) and maxillary (distal) rings, terminating distally in a pair of horny falcate jaws that are toothed along the concave edge. The areas on the maxillary ring are, by convention, numbered from I to IV (dorsal median group I, 2 dorsolaterals II, ventral median III, 2 ventrolaterals IV), those of the oral ring V-VIII (median dorsal V, 2 dorsolaterals VI, median ventral VII, 2 ventrolaterals VIII, VII–VIII more or less continuous).

The areas of the proboscis may be naked or provided with soft papillae (as in *Ceratocephale*, fig. 42*a*), small comblike denticles or pectinae (as in *Platynereis*, fig. 43, *f,g*), or conical horny denticles or paragnaths (as in *Nereis*, fig. 45,*c–e*). The proboscis or pharynx is often everted or may be readily observed by a short incision near the midventral line of the tentacular segment.

At maturity, many nereids undergo a kind of metamorphosis, undergoing profound structural modifications, referred to as the epitokous phase or heteronereis stage. They become much better swimmers than the atokous or nereid form and may become pelagic when discharging their sex products. Epitoky varies from only slightly modified swarmers to sexually dimorphic male and female heteronereids in which the body goes through marked changes, such as: the eyes become extremely enlarged and may cause marked changes in the shape of the prostomium, and usually associated with greater sensitivity to light; body divides into 2–3 distinct regions, a shorter anterior region with the normal type of setae and a more posterior larger region in which the segments are compressed and flattened anteroposteriorly like an accordion, with extra development of thin foliaceous lamellar plates on the parapodial lobes (fig. 44*c*), the normal setae being replaced by a special type of compound homogomph swimming setae in which the blades are flattened, paddlelike (fig. 44*e*); with or without a third most posterior region or "tail," with the usual type of parapodia. In the males, the anterior dorsal and ventral cirri are often modified and clubbed, with curved and pointed tips (fig. 43*h*). In the females, the cirri may be slightly modified. In the modified region in the males, the dorsal cirri are denticulate or crenulate on their lower side and the anal segment is furnished with long to short papillae (so-called anal rosette).

The transformation into the heteronereis is often accompanied by extensive histolysis of certain muscles of the body wall and of the digestive tube and by reorganization of the musculature. The heteronereids may swim to the surface in swarms. All degrees of variation in reproductive pattern are found in the group, as indicated in the following (for more details, see systematic discussion; also see Reish, 1957, and Clark, 1961):

(1) Reproduction in the atokous stage, without epitokous or heteronereis stages, as (a) *Nereis arenaceodonta* (includes *N. caudata*), males and females pair up in tube for lengthy period, where eggs are laid, fertilized, and then incubated by the male; (b) *Nereis diversicolor*, males much less numerous than females; they show a type of pseudocopulation where numerous females move to a mature male and surround him, when the eggs and sperm are given out, followed by fertilization and development in the tube; (c) *Nereis limnicola* Johnson (includes *N. lighti* Hartman; see Smith, 1958, 1959), an internal self-fertilizing hermaphrodite; viviparous, producing young of about 20 segments.

(2) Reproduction by male and female swarmers, forming only slightly modified epitokes but not distinct heteronereids, the adults swarming on the flats or at the surface, as *Nereis virens* and *Nereis japonica.*

(3) Reproduction by markedly modified heteronereids; the adults abandon their tubes or burrows and swarm at the surface, the males pursuing the females. This may be followed by: external fertilization, where the sexual elements are emptied directly into the water and where fertilization and development ensue, as in *Nereis succinea*, *Nereis pelagica*, *Platynereis dumerilii* (at Naples); or internal fertilization by a unique copulatory mechanism, as in *Platynereis dumerilii megalops* in the Woods Hole region. Both males and females die after spawning and the ova give rise to planktogenic larvae.

The nereids are typically free living, mostly living in crevices and burrows, where they construct galleries or a tube. Their general pattern of activity centers around the tube (Clark, 1959).

The terminology for the different types of setae in the nereids is as follows: (a) Compound homogomph spiniger, distal tip of shaft even, blade ends in slender fine tip (fig. 42*e*); (b) compound heterogomph spiniger, distal tip of shaft uneven, blade ends in fine slender tip (fig. 42*f*); (c) compound homogomph falciger, distal tip of shaft even, blade short, ending in blunt tip (fig. 42*h*); (d) compound heterogomph falciger, distal tip of shaft uneven, blade ending in blunt, usually hooked tip; blades may be relatively long (fig. 44*d*) or short (fig. 42*g*); (e) compound homogomph cultrate or swimming seta, blade flattened, paddlelike, characteristic of heteronereids or epitokes (fig. 44*e*); (f) simple falciger, seta with blunt tip, formed by partial or complete fusion of blade to shaft (fig. 44*h*).

All four genera represented have the body vermiform, cylindrical, with numerous segments; the first or tentacular segment achaetous and apodous, with tentacular cirri 3 to 4 pairs.

Key to the New England Genera of Nereidae

1. Parapodia essentially uniramous, notopodium reduced to an aciculum near the base of the dorsal cirrus; without ligules (fig. 41*d*). Tentacular cirri 3 pairs (fig. 41*b*). Proboscis smooth, without paragnaths or papillae. **Lycastopsis** (p. 150)

Parapodia biramous (except for the first 2 pairs), with ligules (fig. 42,*b–d*). Tentacular cirri 4 pairs (fig. 45*a*). Proboscis with paragnaths or papillae . 2

2. From the third setiger on, each parapodium with ventral cirri double (fig. 42*b*). Without notopodial ligules. Proboscis without paragnaths, with soft conical papillae on oral ring (fig. 42*a*) . . . . . .**Ceratocephale** (p. 152)

Ventral cirri single. With notopodial ligules 3

3. Proboscis with small pectiniform denticles or paragnaths (fig. 43,*f,g*). Prostomium suboval (fig. 43*a*). Sexual heteronereids with antennae and palps turned ventrally, usually not visible dorsally (fig. 43*h*). **Platynereis** (p. 154)

Proboscis with conical paragnaths (fig. 45,*c–e*). Prostomium subpyriform, widest posteriorly, narrowed and rounded anteriorly (fig. 45*a*). Sexual heteronereids, when present, with antennae and palps visible dorsally. **Nereis** (p. 160)

Genus *Lycastopsis* Augener, 1922

Type (monotypy): *Lycastopsis beumeri* Augener, 1922;=*L. pontica* (Bobretzky, 1872). Contains only one New England species.

Lycastopsis pontica (Bobretzky, 1872)

Figure 41

Lycastis pontica Bobretzky, 1872, p. 1, pl. 14, figs. 1–4.
Lycastis littoralis Grube, 1872, p. 47.
Lycastopsis beumeri Augener, 1922, p. 42.—Wesenberg-Lund, 1958, p. 14, figs. 9–10.

Lycastopsis augeneri Okuda, 1937a, p. 306, fig. 2.—Uschakov, 1955, p. 204, figs. 62,*a–d*.

Lycastopsis tecolutlensis Rioja, 1946, p. 211, pl. 1, figs. 7–12.—Hartman, 1951, p. 44.

Namanereis quadraticeps Hartman, 1959b, p. 162 (part?).

Description.—Length up to 57 mm., width up to 1 mm., segments up to 125. Body slender, stiff, turgid, widest in the middle, tapering toward both ends, flattened ventrally, strongly arched dorsally. Prostomium (fig. 41*b*) suboval, wider than long. Frontal antennae short, conical. Biarticulate palps short, thick. Two pairs of eyes on posterior half of prostomium, anterior pair larger. Tentacular segment achaetous, about same length or slightly shorter than the following segments; it may overlap the posterior part of the prostomium, concealing the posterior pair of eyes. Tentacular cirri 3 pairs, without basal joints, short, not extending beyond the palps, widest basally, tapering distally.

Parapodia (fig. 41*d*) conical, essentially uniramous. With a dorsal aciculum, without notosetae, with ventral aciculum. Compound neurosetae of 2 kinds: few (2–3) heterogomph spinigers and more

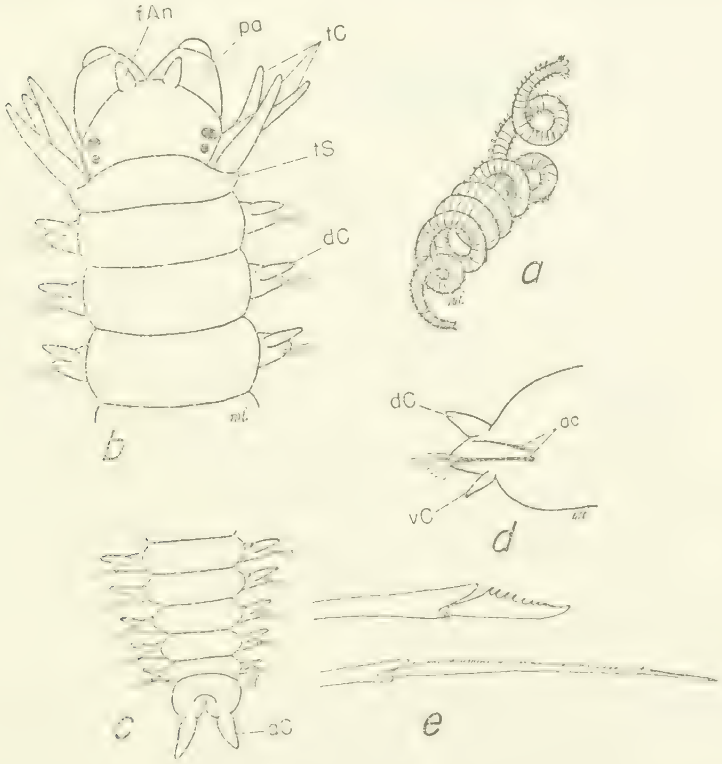

Figure 41.—Nereidae, *Lycastopsis pontica*: *a*, habit sketch; *b*, dorsal view anterior end; *c*, dorsal view posterior end; *d*, parapodium; *e*, neurosetae, compound heterogomph spiniger and falciger.

numerous (4–8) heterogomph falcigers (fig. 41*e*). Dorsal cirri short, conical, extending only slightly beyond the tips of the neuropodia; ventral cirri short, conical. Anal cirri short, conical (fig. 41*c*).

Proboscis without paragnaths, with a pair of amber-colored jaws, each with about 8 teeth (6–8). Color, in life: white to slightly yellowish to yellowish green, with prominent red dorsal and ventral blood vessels; setae and acicula dark; also dark jaws show through; in alcohol: colorless.

BIOLOGY.—A very active worm, coiling up tightly like a spring, in this respect similar to *Glycera* and *Arabella* (fig. 41*a*). They are found high intertidally, crawling under larger rocks overlaying coarse gravelly sand, along with pseudoscorpions, oligochaetes, amphipods, etc. In Japan, it was found in the littoral zone near the high tide mark under decaying sea weeds, with the marine oligochaete *Pachydrilus japonicus* Yamaguchi. Judging from its habitat, it would be expected to be euryhaline. It may be found in brackish areas. It is a primitive aberrant nereid, perhaps a representative of a relic fauna. Other members of the genus are found in tropical regions, some are estuarine, some are found in fresh water. It is probably hermaphroditic as are other members of the genus; some contain very large oval eggs.

MATERIAL EXAMINED.—Massachusetts (Woods Hole region, Gansett, Juniper Point, Little Harbor, Eel Pond, R. Bond and R. Howard, collectors).

DISTRIBUTION.—Massachusetts (Woods Hole region), Virginia (Norfolk), West Indies, Brazil, Black Sea, Mediterranean, central California, eastern Mexico (Vera Cruz), north Japan. In littoral zone near high tide mark and in estuaries.

Genus *Ceratocephale* Malmgren, 1867

Chaunorhynchus Chamberlin, 1919, new name for *Ceratocephale* Malmgren (thought to be preoccupied).—Not *Ceratocephala* Warder (1838, Crustacea).

Type (monotypy): *Ceratocephale lovéni* Malmgren, 1867. Contains only one New England species.

Ceratocephale lovéni Malmgren, 1867

FIGURE 42,*a,b*

Ceratocephale lovéni Malmgren, 1867, p. 61, pl. 5, fig. 33.—Heinen, 1911, p. 62, pl. 1, figs. 11–15.

Ceratocephale websteri Verrill, 1879, p. 172.

Ceratocephala near *loveni* McIntosh, 1902, p. 258, pl. 6.

Chaunorhynchus loveni Hartman, 1942b, p. 49, figs. 83–84.

Ceratocephala loveni Wesenberg-Lund, 1951, p. 39.—Uschakov, 1958a, p. 82, fig. 3.—Eliason, 1962, p 252.

DESCRIPTION.—Length more than 25 mm. (none complete), width up to 7 mm. Body elongate, widest about setigers 3–7, tapering

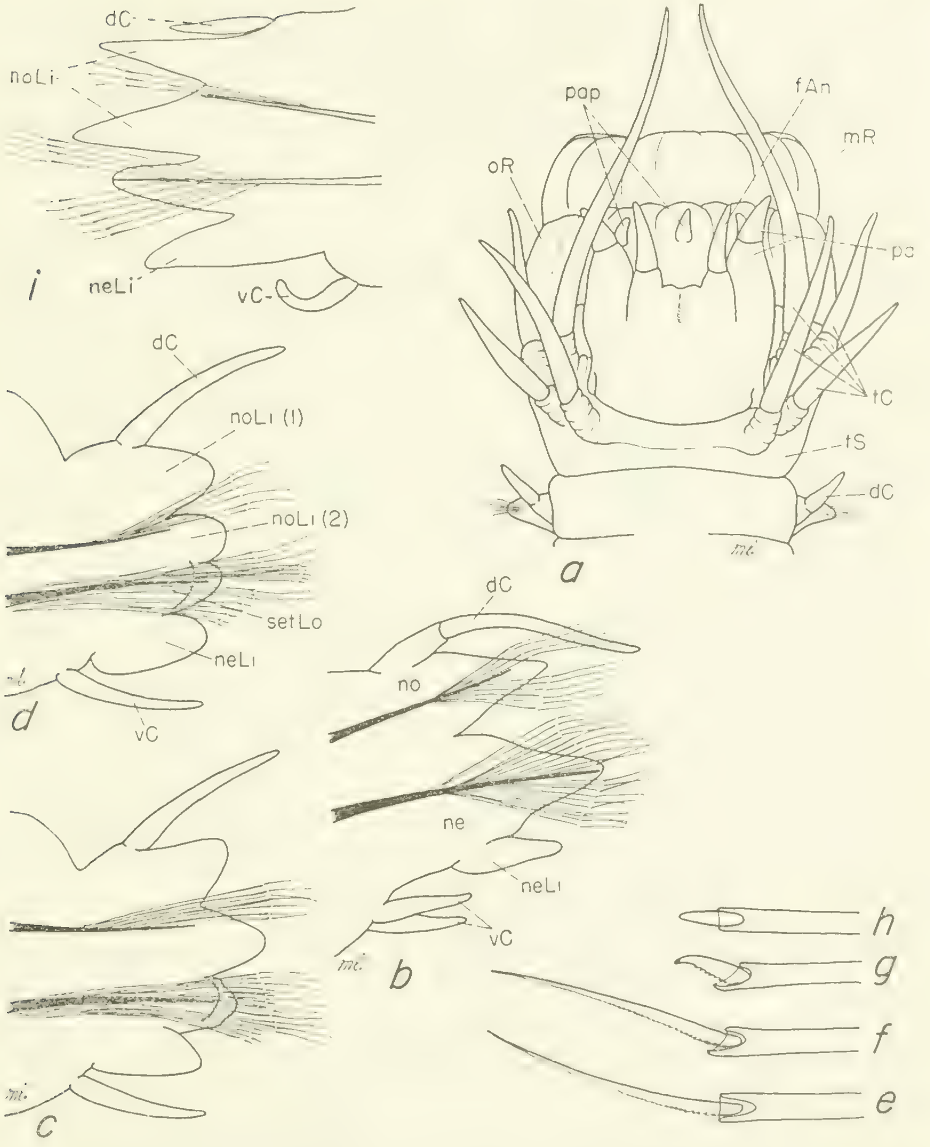

Figure 42.—Nereidae, *a–b*, *Ceratocephale lovéni: a*, dorsal view anterior end, with proboscis partially everted; *b*, parapodium from anterior region. *c*, *Nereis zonata*, parapodium from anterior region. *d–h*, *Nereis pelagica: d*, parapodium from anterior region; *e*, compound homogomph spiniger; *f*, compound heterogomph spiniger; *g*, compound heterogomph falciger; *h*, compound homogomph falciger. *i*, *Nereis grayi*, parapodium

gradually anteriorly and posteriorly. Prostomium (fig. 42*a*) broader than long, incised anteriorly between the bases of the antennae, with a median groove extending posteriorly. Eyes lacking. Two thick palps and 2 more slender frontal antennae present, the palps and antennae subequal in length and fused at their bases, both jointed, the terminal joints short and pointed. Tentacular segment large, swollen, apodous and achaetous, with 4 pairs slender, tapered tentacular cirri. Parapodia (fig. 42*b*) biramous. Notopodia with a conical setigerous lobe with a thick bundle of homogomph spinigers (not spinous). Neuropodia with a conical setigerous lobe and a lower ligule. Upper neurosetae similar to notosetae; lower neurosetae slightly heterogomph spinigers with spines along the cutting edge; setae pale yellow, in thick bundles; acicula dark.

Dorsal cirri slender, tapering; dorsal cirrophores gradually elongated on setigers 9 to 26 or so (may be filled with sex products), when the whiplike dorsal cirri may overlap medially. Ventral cirri single on first 2 uniramous setigers, double on rest. Proboscis (fig. 42*a*) large, muscular, with 2 jaws light brown, curved, with inner edge serrulate (about 11 teeth); without paragnaths; with soft conical papillae on oral ring only, consisting dorsally of 3 papillae and ventrally of 7 papillae in a row followed by 3 smaller ones in a second row. Color, in life (Verrill, 1879): pale brownish or pinkish, dorsal cirrophores and bases of parapodia bright red, setigerous lobes greenish, setae dark at base.

BIOLOGY.—Dredged on bottoms of soft mud and mud with coarse sand and gravel.

MATERIAL EXAMINED.—Off Nova Scotia (43°48′ N., 63°46′ W.) to off Virginia (37°12′ N., 47°20′ W.), in 25 to 1,168 fathoms, *Albatross* stations.

DISTRIBUTION.—Sweden, Norway, Denmark, Iceland, North Sea, Gulf of St. Lawrence to off Virginia, Okhotsk Sea. In 25 to 1,168 fathoms.

Genus *Platynereis* Kinberg, 1866

Nectonereis Verrill, 1873a; type (monotypy): *Nectonereis megalops* Verrill, 1873a; = male epitoke *Platynereis dumerilii megalops* (Verrill, 1873a).

Type (designated by Hartman, 1949): *Platynereis magalhaensis* Kinberg, 1866; = *P. australis* (Schmarda, 1861). Contains only one New England species.

Platynereis dumerilii (Audouin and Milne-Edwards, 1833b)

FIGURE 43

Nectonereis megalops Verrill and Smith, 1874, pp. 146, 159, 298, pl. 12, figs. 62, 63.

Nereis alacris Verrill, 1879, p. 171.

Nereis megalops Verrill, 1879, p. 172; 1881, pp. 301, 320, pl. 5, figs. 1–2; 1882, p. 370.—Andrews, 1891a, p. 284.—Wilson, 1892, p. 371.—Bumpus, 1898c, p. 855.—Miner, 1950, p. 320, pl. 104.

Nereis dumerilii Webster, 1879, p. 234.—Sumner, Osburn, and Cole, 1913, p. 621.—Lillie and Just, 1913, p. 158.—Hoagland, 1919, p. 574.—Just, 1929, p. 307.—Treadwell, *in* Cowles, 1930, p. 342.—Miner, 1950, p. 320, pl. 104.—Wesenberg-Lund, 1951, p. 43.

Platynereis megalops Sumner, Osburn, and Cole, 1913, p. 621.—Just, 1914, p. 201.—Costello, et al., 1957, p. 89.—Hartman, 1959a, p. 278.—Clark, 1961, p. 216.

Platynereis dumerilii Fauvel, 1923, p. 359, fig. 141,*a–f;* 1953, p. 218, fig. 111,*a–f;* 1955, p. 7; 1957a, p. 5; 1957b, p. 214.—Herpin, 1926, pp. 17, 39, 91, 112, 119.—Hartman, 1942a, p. 100; 1944a, p. 339, pl. 16, figs. 3, 7–8, pl. 23, fig. 2; 1944c, p. 17; 1945, p. 22; 1951, p. 47; 1956, p. 281.—Thorson, 1946, p. 67, fig. 31.—Støp-Bowitz, 1948a, p. 62.—Wesenberg-Lund, 1949, p. 288.—Day, 1953, p. 429; 1960, p. 324.—Andrew and Andrew, 1953, p. 9.—Rasmussen, 1956, p. 59.—Southward, 1956, p. 263.—Allen, 1957, p. 52.—Fauvel and Rullier, 1957, p. 79; 1959, p. 52.—Rioja, 1958, p. 257.—Banse, 1959, p. 438.—Clark, 1960, p. 20.

Description.—Length up to 75 mm., width up to 6 mm., segments up to 90. Body cylindrical, tapered posteriorly. Prostomium (fig.

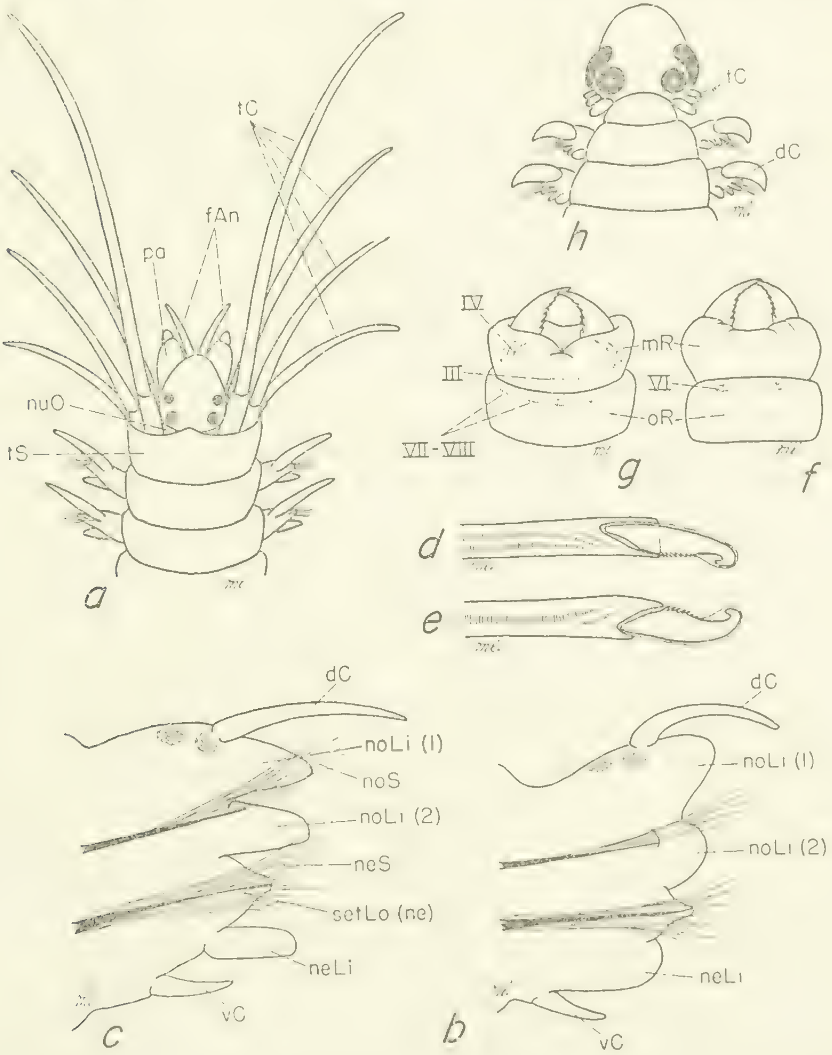

Figure 43.—Nereidae, *Platynereis dumerilii: a,* dorsal view anterior end; *b,* parapodium from anterior region; *c,* parapodium from middle region; *d,* notopodial homogomph falciger from middle region; *e,* neuropodial heterogomph falciger from middle region; *f,* everted proboscis, dorsal view; *g,* same, ventral view; *h,* dorsal view anterior end of male heteronereid, bases of tentacular cirri only present.

43*a*) suboval, with short bulbous palps and slender pointed antennae, slightly longer than the palps. With 4 rather large eyes. With a pair of ciliated nuchal organs posterior to the eyes and which may be pigmented. Tentacular segment slightly longer than the following, with a more or less conspicuous middorsal anterior extension. Tentacular cirri with long cirrophores, with long slender styles, the longest extending to setigers 6–20.

Parapodia with notosetae between two notopodial ligules, a neuropodial setigerous lobe with upper and lower groups of neurosetae, a lower neuropodial ligule. Dorsal cirri longer than the ligules; ventral cirri about as long as the neuropodial ligule. In the anterior region, the parapodia (fig. 43*b*) are formed of 4 short, rounded, closely appressed lobes. The notosetae are homogomph spinigers. The upper group of neurosetae are homogomph spinigers and heterogomph falcigers with short appendages, the lower group of neurosetae are heterogomph spinigers and falcigers. In the middle and posterior regions, the parapodia (fig. 43*c*) are formed of 4 conical lobes, more elongate and tapering than in the anterior segments, the lobes rather widely separated, each with 2 large, more or less conspicuous dark-colored glands at the bases of the dorsal cirri. Beginning on about setiger 20, some of the lower notosetae are replaced by a few (1–4) homogomph falcigers with a recurved tip (fig. 43*d*). The neurosetae are similar to those of the anterior segments except that the heterogomph falcigers have short blades with a recurved tip (fig. 43*e*). The acicula are black. Anal cirri 2, about as long as the tentacular cirri. Proboscis (fig. 43,*f*,*g*) with pale amber-colored jaws, each with 5–13 teeth, with paragnaths in the form of very small, fine, pectinate denticles (may be very pale and difficult to detect). Denticles absent from areas I, II, and V; group III, small transverse mass of 3 groups, each with 1, 2, or 3 rows; group IV, several parallel pectinate rows (3–5 rows); group VI, 2–3 curved rows; groups VII–VIII, 5–7 masses of 1–2 rows each (in small specimens, may be difficult to see separate rows; in heteronereids, may form a fused mass).

Color in life: iridescent, bright olive green tinged with orange-red "freckles" or dots; yellow with greenish spots and whitish splotches (specimens on gulfweed); young translucent, nearly white with some red specks on surface; color variable, greenish, yellowish, pink, reddish with violet chromatophores, the pigment may be uniformly spotted or somewhat banded (Fauvel). Color, preserved: may show dorsally dark bands of dots and darker spots at the bases of the parapodia, 2 spots basal to the dorsal cirri, in the tips of the ligules, on the bases of the ventral cirri and scattered spots ventrally.

Both male and female heteronereids show marked changes from the atokous form in that the eyes become greatly enlarged; the antennae and palps are directed ventrally and are not visible dorsally (fig. 43*h*); body is divided into 2 regions, anterior region with setae similar to atokous form and posterior region tapering gradually, with swimming setae (since the notopodial homogomph falcigerous setae of the atokous form begins around setiger 20 and are replaced by swimming setae up to the posterior end, they will not usually be found in the heteronereids). Extra thin flattened lamellae are on the parapodia and bases of the dorsal and ventral cirri. Pygidium with a pair of midventral cirrophores with the anal cirri, or cirri may be broken off. Table 1, page 158, shows how the sexually dimorphic males and females differ.

Biology.—The species, including male and female heteronereids massed with eggs and many small ones, is particularly associated with algal masses (*Fucus*) and floating seaweed (*Sargassum*). It is very active in all its motions, swimming rapidly. It forms tenacious, transparent, parchment-like or weakly chitinized tubes on the algae, in which foreign material, such as sand grains or fragments of bryozoans, may be incorporated irregularly. It is found in crevices of rocks, on pilings, wharfs, among algae, sponges, and hydroids (as *Pennaria*). It is dredged in rather shallow waters on shelly bottoms, among bryozoan nodules, ascidians and sponge clumps. It feeds on algae. The heteronereids are found at the surface as well as the young of all sizes from 6–8 segments up to 10 mm. or more in length.

In the Woods Hole region, sexual forms are found at the surface during the summer months from June into September (Bumpus, 1898c, Verrill, 1882, Wilson, 1892). According to Just (1914) in the Woods Hole region, they show lunar periodicity, swarming during the dark of the moon during the months of July and August. At Beaufort, North Carolina, they are found in June and July (Hartman, 1945). At Naples, they are found swarming from October to May, tending to center around the time of the first and third quarters of the moon (Lillie and Just, 1913).

The species is noted for its extreme reproductive plasticity. Some of the reports may be due to confusion of species, due to difficulty in detecting distinguishing morphological characters or due to somewhat abnormal conditions. The following have been reported for the species, mostly studied in the Mediterranean (Moquin-Tandon, 1869; Herpin, 1926; Hauenschild, 1951):

A. Epitokous, heteronereid forms, metamorphosing into sexually dimorphic males and females which become pelagic and swarm at the surface; the eggs have relatively less yolk (with few relatively large yolk droplets, eggs under 180 μ in diameter, according to Hauenschild, 1951) and develop into planktogenic swimming trocho-

TABLE 1.—*Differences between sexually dimorphic males and females in* P. dumerilii.

Characters	*Male heteronereid*	*Female heteronereid*
Size	Smaller, due to greater compression of segments; 18–24 mm. long, about 90 segments	Larger; 31–47 mm. long, about 90 segments
Color	Greenish anteriorly, pinkish to reddish more posteriorly	Pale greenish or yellowish, often nearly white
Swims	Rapidly, with jerky movements, rotating in spirals	Slowly, usually at greater depths
Prostomium	Elongate-oval, longer than wide; anterior pair eyes very large, directed ventrally, posterior pair smaller, directed dorsally (fig. 43*h*)	Oval, wider than long, anterior pair eyes larger, directed laterally (not as large as in male); posterior pair directed dorsally
Dorsal cirri of anterior region	First 7 pairs clubbed, with slender oblique terminal part, becoming progressively longer posteriorly (seventh about double the length of the first)	First 4 pairs slightly modified
Ventral cirri of anterior region	First 4 pairs clubbed, larger than following	First 4 pairs slightly modified
Number of setigers in anterior region (prenatatory)	Usually 14 (12–15)	Usually 21 (20–27)
Dorsal cirri of posterior modified or natatory region	Crenulate on lower margin	Smooth, not crenulate
Neuropodial lamellar plate of modified or natatory region	Very large, entire (not bilobed), thin, flat, about as long as neurosetae	Smaller, bilobed, much shorter than neurosetae
Anal segment or pygidium	An anal disc with a middorsal extension and a circle of papillae (both may be variable in shape as they may be extended or contracted)	Bulbous, without papillae
Sex products	Sperm massed in anterior region	Whole body massed with large yolky eggs

phores and forming 3-segmented pelagic larvae with long compound setae. Two modifications are:

(1) A noncopulatory external fertilization, as reported by Just (1929) and others for *P. dumerilii* at Naples. Around the slowly swimming female, the active males move with ever increasing rapidity and more closely set spirals. The males then discharge their sperm, into which the female discharges her eggs, and then the adults sink to the bottom of the sea.

(2) A remarkable copulatory mechanism followed by internal fertilization, as described by Just (1914) for *Platynereis megalops* in the Woods Hole region (*P. megalops* seems indistinguishable morphologically from the Mediterranean *P. dumerilii* and has been put into synonomy herein, as has been done by others; it may be, however, that the species are distinct; *megalops* should probably at least be considered as a subspecies). The small, reddish males appear first, swimming with great rapidity in an ever narrowing circle while the larger, pale yellow females appear later. As the male comes in the vicinity of the female, he swims very rapidly in spirals, entwining the female. The female receives the anal segments of the male in her jaws, the sperm are swallowed and pass through lesions of the pharynx into the body cavity; the sexual adults separate and the fertilized eggs stream from the posterior segments of the female through lesions of the body wall (about 6 seconds after the female has received the anal segments of the male; previously the body wall of the female has become extremely thin and the digestive tract has become but a remnant); the female sinks from view and apparently dies.

B. Atokous nereid form, without metamorphosis; yolky eggs (over 250 μ in diameter, filled compactly with small yolk globules, according to Hauenschild, 1951) are deposited in the tube and incubated by the male; nonpelagic neridogenic larvae of three segments leave the egg membranes and creep away. The atokous forms are protandric hermaphrodites, described originally for *Nereis massiliensis* Moquin-Tandon, 1869. Thus the following may be found:

(1) Small greenish "males" filled with ripe sperm and small unripe eggs;

(2) Larger yellowish females with yolky eggs (the sperm usually disappear by the time the eggs ripen).

When "males" are present, the females shed the eggs within the tube where they develop, incubated by the "male" (Herpin, 1926); the female dies sometime after spawning; in the protandric "male," the eggs mature, and it becomes a female. According to Herpin (1926) and others, this is to be considered a reproductive phase of *P. dumerilii*. According to Hauenschild (1951), *P. dumerilii* and *P. massiliensis* should be considered as distinct, the former reproducing only as bisexual heteronereids, spawning at the surface and producing planktogenic larvae; the latter reproducing as protandric hermaphroditic atokous individuals, spawning within the tube and producing nonpelagic nereidogenic larvae.

Rarely has viviparity been reported, perhaps as an accidental consequence of the unusually long survival of sperm in the body cavity of "hermaphroditic females," and of self-fertilization taking place.

MATERIAL EXAMINED.—Numerous specimens from Massachusetts (Buzzards Bay, Vineyard Sound on gulf-weed; Martha's Vineyard, Gay Head, Lagoon Pond; Woods Hole region, Eel Pond, Fisheries Dock and Steamship Wharf, Nobska, Stony Beach, North Falmouth; Elizabeth Islands; Cape Cod Canal; Wellfleet, Cape Cod), Rhode Island (off Newport), Long Island Sound, Maryland (lower half Chesapeake Bay, southwest Ocean City, Foxhill Levels, Assateague Island, Chincoteague Bay), Georgia, North Carolina (Beaufort), Puerto Rico (Caballo Blanco and Mona Island Reef, Parguera, heteronereids, M. J. Allen), Barbados (Pelican Island).

DISTRIBUTION.—A cosmopolitan form with wide geographic distribution in warm seas. Massachusetts (Cape Cod), south of Newfoundland (surface) to Florida, Gulf of Mexico, West Indies, Brazil, Iceland, Faroes, Scandinavia to France, Mediterranean, Iranian Gulf, Red Sea, Indian Ocean, central Pacific (Bikini), West and South Africa. In low water to 71 fathoms; young and sexual epitokes in surface waters; all stages in floating seaweed (*Sargassum*).

Genus *Nereis* Linné, 1758

Type (designated by Hartman, 1949): *Nereis pelagica* Linné, 1758.

Subgenus *Neanthes* Kinberg, 1866; emend. Hartman, 1940

Type (designated by Hartman, 1959a): *Neanthes vaalii* Kinberg, 1866.

Subgenus *Hediste* Malmgren, 1867

Type (monotypy): *Hediste diversicolor* (O.F. Müller, 1776).

In *Neanthes* Kinberg, as originally defined and followed by Fauvel and others, all the areas of the proboscis are equipped with hard and discrete paragnaths, while in *Nereis* Linné, sensu stricto, 1 or several groups of paragnaths are lacking. The distinction may fail when considering the variability within a single species, as has been shown for *Nereis virens* by Turnbull (1876) and Berkeley and Berkeley (1954). Based on the types, the definitions of the genera have been revised by Hartman (1940, pp. 219–220). It seems advisable to denote the close relationship of the North Atlantic *N. diversicolor* O.F. Müller, *N. limnicola* Johnson from the North American Pacific coast (including *N. lighti* Hartman), and *N. japonica* Izuka from the Japanese Pacific (see Smith, 1958, 1959) by including them in the same subgenus. The 3 species are morphologically very similar, denoting a possible common ancestry but they may be distinguished by reproductive habit and the morphology of the sexually mature individuals. Also they are reproductively and geographically isolated. Hartman (1959a, 1960a) has referred them all to *Neanthes diversicolor*, an action which ignores the differences in reproductive pattern as well as other differences pointed out by Smith.

The species of *Nereis* represented have the body elongate, cylindrical, tapering anteriorly and posteriorly. Prostomium (fig. 45,*a,e*) subpyriform in shape, widest posteriorly, tapering and rounded anteriorly, with 4 eyes on the posterior half. Tentacular segment slightly longer than or up to double the length of the following segments, with 4 pairs of tentacular cirri. Pair of anal cirri of variable length.

Key to the New England Subgenera and Species of *Nereis*

1. Preacicular notopodial lobe elongated, thus provided with 3 notopodial ligules (fig. 44,*a,f,g,i*). Notopodia with homogomph spinigerous setae only (fig. 42,*e*), without falcigerous setae 2
   Without elongated preacicular notopodial lobes, thus provided with 2 notopodial ligules (fig. 42,*c,d*). Middle and posterior notopodia provided with homogomph falcigers in addition to spinigers (fig. 42*h*) (subgenus NEREIS sensu stricto) 5
2. Supraacicular neuropodial bundle of setae in posterior region with homogomph spinigers and few (1–3) heavy specialized falcigers with end pieces wholly or partially fused to shafts (fig. 44*h*) (subgenus HEDISTE). Upper notopodial ligule triangular, not especially enlarged (fig. 44*g*). Without heteronereid stage; spawns in burrows . . . . . . **N. (Hediste) diversicolor** (p. 174)
   Without fused neurosetae in upper bundle of posterior neuropodia (subgenus NEANTHES) 3
3. Basal or oral ring of proboscis with continuous broad band of small denticles (fig. 45*e*). Without heteronereis stage.
   N. (Neanthes) arenaceodonta (p. 162)
   Oral ring of proboscis with denticles in groups, not forming a continuous band (fig. 45*c*). With or without heteronereis stage 4
4. Parapodia greatly modified in posterior region—upper dorsal ligules become elongate, straplike, with dorsal cirri terminal (fig. 44*b*). With greatly modified heteronereis stage, swarms at surface.
   N. (Neanthes) succinea (p. 165)
   Parapodia not greatly modified anterior to posterior. Upper dorsal ligules broadly triangular, much larger than the other ligules (fig. 44*f*). With slightly modified heteronereid stage, swarms on flats or at surface.
   N. (Neanthes) virens (p. 170)
5. Proboscis with paragnaths few in number, lacking entirely on areas VII–VIII. Parapodial ligules sharply conical (fig. 42*i*) . . **N. (Nereis) grayi** (p. 183)
   Proboscis with paragnaths more numerous, present on areas VII–VIII . . . 6
6. Parapodial ligules short, thick, evenly rounded (fig. 42*d*). Body uniformly pigmented, not banded. Paragnaths of areas VII–VIII with 1–2 irregular

rows of larger paragnaths followed by several rows of small ones, diminishing in size posteriorly . . . . **N. (Nereis) pelagica** (p. 179)

Parapodial ligules triangular to conical, gradually tapering to a broad tip (fig. 42*c*). Body usually transversely banded (may be faint or absent in young specimens). Paragnaths of areas VII–VIII with continuous row of larger paragnaths followed by a wide band of small subequal ones. **N. (Nereis) zonata** (p. 181)

Nereis (Neanthes) arenaceodonta Moore, 1903c

FIGURES 44*i*, 45*e*

Spio caudatus Delle Chiaje, 1822, pl. 28, figs. 10, 15; 1825, pp. 403, 432. Not (Savigny, MS.) Lamarck, 1818, p. 319.

Nereis (*Neanthes*) *caudata* Delle Chiaje, 1841, pp. 96, 104, pl. 102, figs. 10, 15.—Fauvel, 1923, p. 347, fig. 135, *a–e*; 1955, p. 7.—Herpin, 1926, pp. 18, 101, 120.—Day, 1953, p. 425; 1960, p. 324.

Nereis arenaceodonta Moore, 1903c, p. 720, pl. 40, figs. 1–10.—Sumner, Osburn, and Cole, 1913, p. 620.—Benham, 1916, p. 134, pl. 46, figs. 1–3.

Neanthes cricognatha Knox, 1951, p. 217, pl. 45, figs. 6–8.

Neanthes caudata Renaud, 1956, p. 16, fig. 11.—Reish, 1957, p. 216, figs. 1–9; 1959, p. 81.—Rioja, 1958, p. 255.

DESCRIPTION.—Length up to 70 mm., width up to 4 mm., segments up to 75. Prostomium (fig. 45*e*) about as long as broad, strongly convex anteriorly. Tentacular cirri relatively short, longest reach setigers 3–9. Parapodia (fig. 44*i*) relatively long, similar throughout the length of the body. Notopodia with 3 ligules, upper one larger, triangular; middle or presetal and lower ones subequal, pointed. Neuropodia with 2 slender, pointed ligules, postsetal and subsetal. Acicula colorless. Notosetae a fan-shaped bundle of homogomph spinigers; both upper and lower groups of neurosetae homogomph spinigers and heterogomph falcigers with relatively long hooked blades. Dorsal and ventral cirri subequal, shorter than the upper notopodial ligule.

Proboscis (fig. 45*e*) with brown curved jaws, each with 6–15 teeth. Paragnaths of oral or basal ring (areas V–VIII) forming a continuous broad band; area I, an elliptical group of denticles; area II, crescentic groups; area III, an elongate oval group; area IV, triangular groups. Color, in life: white, transparent, pale yellow or bright pink with brownish or purple (Fauvel); color, preserved: splotched with brownish or bluish on prostomium and first few segments, in bases of parapodia and ligules, the pigment may be irregularly scattered in the body or may be somewhat banded.

BIOLOGY.—Found at low water in muddy sand and sand, on *Diopatra* tubes, in mussel beds, and with sponges and algae. Found on drifting algae. Dredged on bottoms of gravel, mud, sand, among tunicates (as sandy *Amaroccium*). According to Herpin (1926), it is found on the lower side of rocks covered with the green alga *Enteromorpha*, where these rocks rest on muddy sand and even quite compact clay; it constructs tubes with thin walls but often incrusted with mud and debris, the tubes adhering feebly to the rocks. Herpin found that, when available, it feeds on the *Enteromorpha* as well as on diatoms and filamentous algae and that it may occasionally be carnivorous, capable of attacking and digesting prey larger than itself. Although small, *N. arenaceodonta* shows extreme agility, swimming easily and rapidly.

It has been found swimming at the surface in Vineyard Sound in August (1882, 1902, 1904) and October (1882). It is taken at the surface in both the immature and mature condition. It lacks a heteronereis stage. Specimens were found with relatively few large yolky eggs, about 9 eggs per segment and nearly as great in diameter

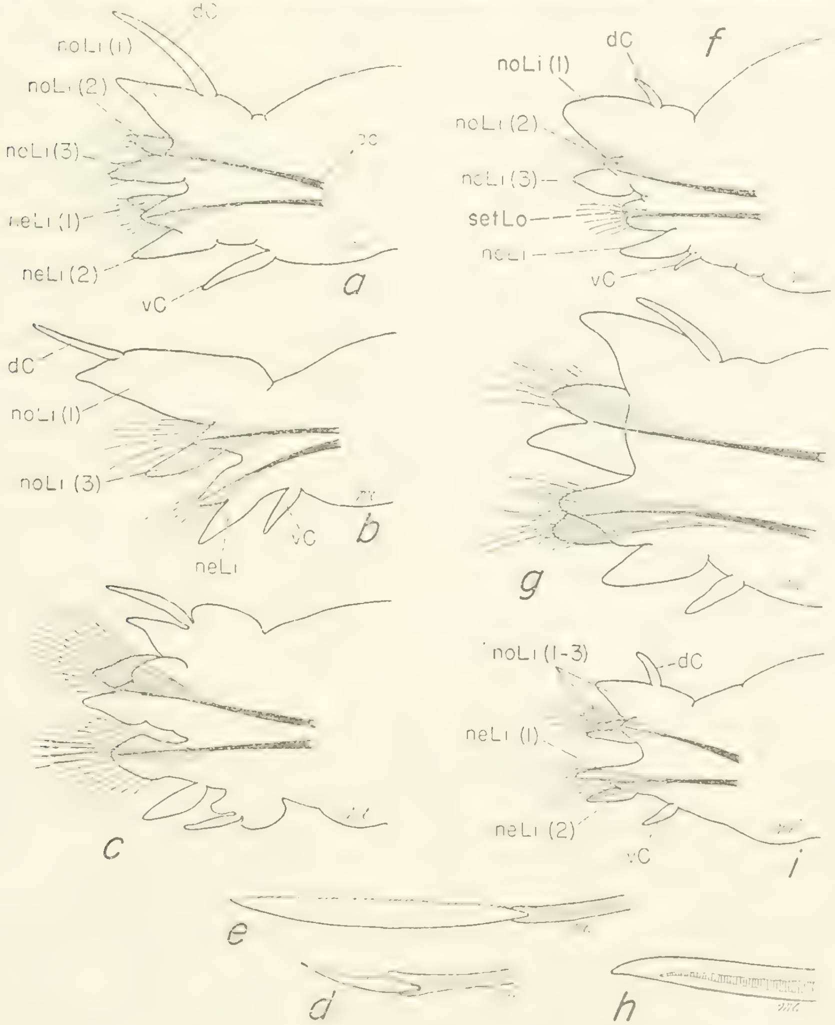

FIGURE 44.—Nereidae, *a–e*, *Nereis succinea: a*, parapodium from anterior region; *b*, parapodium from posterior region; *c*, parapodium from segment 25 of female heteronereid; *d*, compound heterogomph falciger; *e*, swimming seta of heteronereid. *f*, *Nereis virens*, parapodium from middle region of body. *g–h*, *Nereis diversicolor: g*, parapodium from anterior region; *h*, simple neuropodial falcigerous seta from posterior region. *i*, *Nereis arenaceodonta*, parapodium from middle region.

as the length of the segment (August 22, 1950, Lackeys Bay, Nonamesset Island, Massachusetts). Herpin (1926), in studying the reproductive habits of the species in the English Channel (Cherbourg, France), found that the eggs are of quite unusual size, at maturity reaching a diameter of 600 μ and filled with abundant yellow yolk in the form of globules of quite small diameter; the sperm are extremely scanty and of quite aberrant form.

Spawning is preceded by a long period of at least 4 months of couple formation (beginning at the first of May in Cherbourg). This period is associated with a fighting reaction: a female will fight off other females but is attracted to a male; the males will fight off any males and, while incubating the eggs, any females; the proboscis is everted and the jaws extend to grasp the opposing animal. A male and female construct a single cylindrical tube provided with numerous openings, staying side by side and separating only rarely. The eggs are laid and fertilized in the tube, after which the female leaves the tube and apparently dies after a short time. Reish (1957) found that the females either died 2–3 days after egg laying or were eaten by the males. The male remains and incubates the eggs by executing continual regular undulatory movements, assuring the renewal of water over the eggs. The fertilized eggs adhere to one another and to the wall of the tube, the male having arranged the eggs with his proboscis. Freshly laid eggs were molded into a mucoid tube of one egg in thickness by the male, according to Reish; the males may resume their former life and may reproduce and incubate larvae more than once.

The early development has been followed by Herpin (1926, Cherbourg, France) and by Reish (1957, southern California). They found that it develops into a nonciliated embryo, which is unique among the nereids. Herpin found that the larvae hatch from the fertilization membrane after about 11 days (7 days, according to Reish) as a hemispherical larva possessing 3 setigers, with anal cirri, with a mouth but no jaws, and with a large amount of yolk globules. The larvae develop rapidly and, after 30 days (about 21 days, according to Reish), may possess 20 pairs (17–19 pairs, according to Reish) of parapodia, the reserves being exhausted; they differ from the adult only by the absence of the fourth pair of tentacular cirri. The larvae leave the tube only after the disappearance of the reserves and at a very advanced stage, thus compensating for the small number of eggs. Reish found 143 to 791 larvae per parent tube. They construct mucoid tubes and begin to feed, there being no true planktonic stage. Development is effected in a single year (Reish found that sexual maturity was reached in 2 months and that 5 generations completed their life cycle in the laboratory within a period of 1 year).

Material examined.—Massachusetts (*Albatross* III, 41°21′ N., 67°59′ W., 1955, R. Wigley; Woods Hole region, Vineyard Sound, Naushon Island, Lackeys Bay, Nonamesset Island, Nobska, North Falmouth, Nantucket Sound; Cape Cod, Provincetown, Wellfleet Harbor, Barnstable), Rhode Island (Newport), New Jersey (Raritan Bay), Maryland (Assateague Island in Chincoteague Bay), low water to 18 fathoms.

Distribution.—English Channel to Santander, Mediterranean, Massachusetts (Cape Cod) to Maryland (Chincoteague Bay), Florida, southern California, Mexico, Philippine Islands, Australia, New Zealand, northeastern Tasmania, South Africa, India. In low water to 55 fathoms; surface.

***Nereis (Neanthes) succinea* (Frey and Leuckart, 1847)**

Figures 44,*a–e*; 45,*a–d*

Nereis limbata Webster, 1879, p. 235, pl. 6, figs. 70–75; 1886, p. 139, pl. 6, figs. 21, 22.—Verrill, 1881, pp. 296, 300, 308, 317, 321, pl. 5, fig. 3.—Webster and Benedict, 1884, p. 718.—Andrews, 1891a, p. 284.—Wilson, 1892, p. 361.—Bumpus, 1898a, p. 485; 1898b, p. 58; 1898c, p. 850.—Mead, 1900, p. 308.—Wilson, 1900, p. 351.—Lillie and Just, 1913, p. 147.—Sumner, Osburn, and Cole, 1913, p. 621.—Hoagland, 1919, p. 574.—Treadwell, *in* Cowles, 1930, p. 342.—Miner, 1950, p. 322, pl. 105.—Pratt, 1951, p. 330, fig. 454.—Nicoll, 1954, p. 69, fig. 4.—Costello, et al., 1957, p. 83.

Nereis (Neanthes) succinea Fauvel, 1923, p. 346, fig. 135 (part); 1936c, p. 312.—Støp-Bowitz, 1948a, p. 62.—Berkeley and Berkeley, 1953, p. 847; 1954, p. 45; 1958, p. 402.—Day, 1953, p. 425; 1957, p. 78; 1960, p. 321.—Newell, 1954, p. 334.—Banse, 1954, p. 160, figs. 1–14.—Tebble, 1955, p. 94, figs. 9–10.—Rasmussen, 1956, p. 59.—Amos, 1957, p. 3.—Fauvel and Rullier, 1957, p. 75; 1959, p. 523.—Clark, 1961, p. 214.

Neanthes succinea Hartman, 1938a, p. 79; 1944a, p. 339, pl. 16, figs. 4–6; 1944c, p. 17; 1945, p. 17, pl. 3, figs. 1–2; 1951, p. 45.—Wesenberg-Lund, 1958, p. 27: 1962, p. 78.—Hartmann-Schröder, 1959, p. 142.

Description.—Length up to 190 mm., width up to 7 mm., segments up to 160. Tentacular cirri slender, tapering, longest reach setigers 3–8. Parapodia differing much in form from anterior to posterior end. Parapodia of anterior region (fig. 44*a*) with 3 notopodial ligules, the upper one largest, conical; the lower one smaller; the middle or presetal one still shorter. Neuropodium with setigerous lobe, a longer postsetal ligule, and a conical lower ligule. Dorsal cirri do not extend beyond or only slightly beyond the ligules; ventral cirri shorter than the ligules.

The parapodia change gradually in form in the middle region. In the posterior region the parapodia (figs. 44*b*, 45*b*) differ markedly in form: the notopodium with the upper dorsal ligule elongated, strap-like, flattened, obliquely truncate distally, with the dorsal cirrus in a terminal position; middle notopodial ligule rudimentary or lacking; lower one short, conical. Neuropodium similar to anterior region

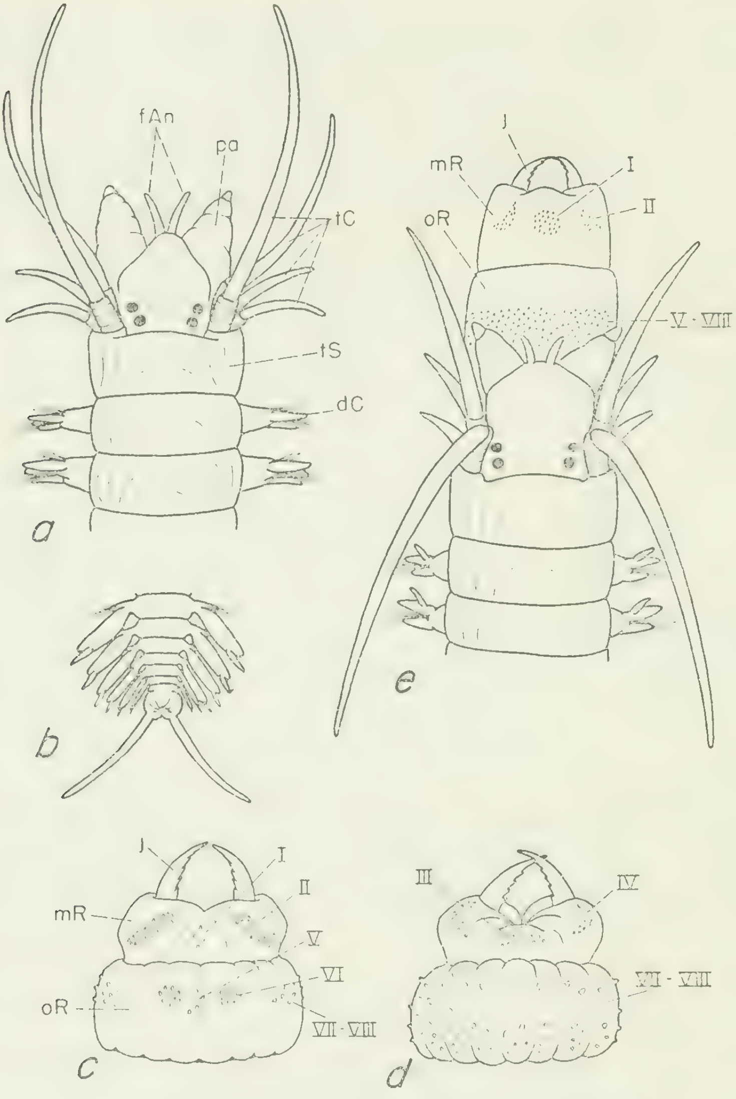

FIGURE 45.—Nereidae, *a–d*, *Nereis succinea:* *a*, dorsal view anterior end; *b*, dorsal view posterior end; *c*, dorsal view extended proboscis showing jaws and general arrangement of paragnaths; *d*, same, ventral view. *e*, *Nereis arenaceodonta*, dorsal view anterior end with proboscis extended.

except the postsetal ligule is rudimentary or lacking. Acicula black. Notosetae homogomph spinigers. Upper group of neurosetae homogomph spinigers and heterogomph falcigers (fig. 44*d*); lower group of neurosetae heterogomph spinigers and falcigers.

Proboscis (fig. 45, *c*, *d*) with light amber-colored jaws, each with 4–9 teeth, with amber-colored denticles usually on all 8 areas: Area I, 1–6 denticles; areas II and IV, arched groups; area III, oval group; area V, 1–6 denticles (rarely 0); area VI, oval groups; areas VII–VIII, 2–3 irregular rows. Color, in life: brownish anteriorly including darkly pigmented prostomium, greenish, greenish yellow or pale red posteriorly, dotted with white, or dark over entire dorsum; color, preserved: darkly pigmented anteriorly, including prostomium and bases of parapodia.

Both male and female heteronereids show marked changes from the atokous form. They are considerably shorter due to the anteroposterior flattening of the segments. The eyes are enlarged and they are attracted to light. Body is divided into 3 regions: anterior region (13–18 setigers) with setae similar to the atokous form; middle or natatory region (29–40 setigers) with flattened parapodia with swimming setae, with thin flattened extra lamellae on the parapodial lobes and bases of the dorsal and ventral cirri; a posterior region or "tail" (25–56 setigers) with parapodia similar to the atokous form (this region thus shows the characteristic straplike upper notopodial ligules, although this region may be broken off). The anal segment or pygidium is crenulate, shorter than in the asexual form. Table 2 below shows how the sexually dimorphic males and females differ.

TABLE 2.—*Differences between sexually dimorphic males and females in* N. (Neanthes) succinea

Characters	*Male heteronereid*	*Female heteronereid*
Size	Smaller usually; 14–55 mm. long, up to 5 mm. wide	Larger usually; 30–75 mm. long, up to 7 mm. wide
Color	Bright red with white posterior end	Paler, often nearly white or pale yellow green
Swims	In peculiar swift gyrating motion or in wide circles; actively pursues female	More slowly
Prostomium	Eyes larger, more bulging, enlarged so as to nearly touch each other	Eyes not quite so enlarged
Dorsal cirri of anterior region	First 7 pairs inflated subterminally	First 5 pairs slightly modified
Number of setigers in anterior region (prenatatory)	Usually 15 (13–15)	Usually 17 (13–18)
Dorsal cirri of middle modified region	Crenulate on lower side	Smooth, not crenulate
Neuropodial lamellar plate of modified region	Large, oval, entire, nearly as long as neurosetae	Shorter, rounded with short outer tip (fig. 44*c*)

Biology.—The species is notably euryhaline. It is found from moderately high tide line to subintertidal levels, under strictly marine conditions and ascending tidal streams to brackish water where it may be able to withstand considerable flooding of fresh water. Thus it is found in bays, estuaries, marsh ditches, and mangroves. It is found in a great variety of niches in the intertidal area, in oyster beds where it may form burrows in the crevices of the oyster shells (along with *Polydora* and *Hydroides*), among barnacles, mussels, and sponge masses. It is found on the under sides of rocks and stones or boards, on pilings of wharfs among barnacles and ascidians. It may occur in old tubes of *Diopatra*, *Maldanopsis*, *Hydroides*, and *Polydora*. It is found on sandy shores, especially where there is a mixture of mud with the sand, in coarse sand, in stiff muddy sand, in gravelly and shelly mud, in peat, in soft mud of brackish water regions; it may occur in very foul soft mud. It has also been dredged in mud.

It forms typically a broad U-shaped burrow, open to the surface at both ends. It can burrow rapidly. It prefers coves and harbors, bays and sounds, not exposed beaches of moving sand; the burrows may be semipermanent or more or less temporary, the worms crawling within the burrows, the anterior end extending out some distance from the burrow and withdrawing back rapidly. It may also live with the head end downward with the posterior end close to the surface or protruding. New burrows are constructed frequently.

It is extremely abundant in Great Bay, New Hampshire and the rivers leading into it. In New Jersey, it is common everywhere in the harbor except in pure sand. It is common in Delaware Bay, the most flourishing community being in the midbay region where the salinity averages between 20 to 21 parts per thousand (Amos, 1957). It is the most common annelid in Chesapeake Bay. It is the commonest and most widely distributed nereid in the vicinity of Beaufort, North Carolina. It is very abundant in many intertidal areas in the Gulf of Mexico. It no doubt serves as an important food item to bottom-feeding animals such as crabs and skates.

The swarming sexually mature adults may be found in immense numbers, in the daytime and evening, when they are attracted to the light. They have been reported swarming in Miramichi Bay, New Brunswick, in June (Berkeley and Berkeley, 1953); they were swarming in such large numbers that a fisheries patrol boat at first mistook the swarm for a sand bar; the surface of the sea over a wide area was in a state of violent turmoil. In the Woods Hole region and Vineyard Sound, they have been observed swarming in March, May, June, July, August, September, first of October (Bumpus, 1898a–c; Wilson, 1892). They were seen in large numbers in Rhode Island in May (Mead, 1900). They have been observed swimming in incredible numbers in Long Island Sound in August (Verrill and Smith, 1874), when they were eagerly pursued by the bluefish. They have been observed breeding in September in Beaufort, North Carolina (Wilson, 1900; Andrews, 1891a). They appeared in large swarms swimming in the Cooper River, South Carolina, opposite the Navy Yard, April 23, 1925 (reported by Commander A. K. Atkins, specimens in USNM).

The swarming behavior has been followed by Lillie and Just (1913) and others in the Woods Hole area. They were taken after sunset on certain nights, in general, during the "dark of the moon" during June to September. They appear swimming near the surface of the water very soon after sunset and may be attracted by a light. The swarming usually begins with the appearance of a few males, distinguished by their bright red anterior segments and white sexual posterior segments, darting rapidly through the water in curved paths. The much larger females, paler in color, often nearly white, then begin to appear, usually in smaller numbers, swimming slowly through the water. They increase in number for a time, then decrease and finally disappear after a couple of hours. The female is surrounded by several males, which swim rapidly in narrow circles about her. The males begin to shed sperm and soon the female begins to shed her eggs, then slowly sinks into the water to die. Some kind of emanation from the mature egg-filled females incites the males to shed sperm. For the female, the presence of sperm in the sea water incites the shedding of eggs.

The early development has been followed by Banse (1954, in Kiel Bay in western Baltic); the adults swarm in July; the eggs are about 140μ in diameter; they develop rapidly into planktotrophic larvae and change to bottom forms when they have 4–6 segments, playing no further role in the plankton; occasionally they may remain in the plankton until they are 1.4 mm. long.

Material examined.—Numerous specimens from Gulf of St. Lawrence (Prince Edward Island), Nova Scotia (Cape Breton Island), Newfoundland, Maine (Days Cove, Damariscotta River), New Hampshire (mouth of Squamscott River, Great Bay, mouth and middle of Oyster River, Belamy River), Massachusetts (Buzzards Bay; New Bedford; North and South Ponds, Megansett Estuary; Elizabeth Islands; Cape Cod, Sandwich, Wellfleet, Follins Pond, head of Bass River, West Yarmouth, Cotuit; Martha's Vineyard, Lagoon Pond, Senekontacket Pond), Connecticut (New Haven), Rhode Island, New Jersey (Long Island Sound), Delaware (Assonoman Bay), Maryland (Chesapeake and Chincoteague Bays; Ocean City), Virginia (Cape Charles, Norfolk), North Carolina (Beaufort), South Carolina (Cooper River, opposite the Navy Yard), Florida (Apalachicola Bay), Mississippi, Louisiana (St. Bernard Parish, Dutchman Gap; St. Bernardo Pass; Half-Moon Island; Drum Bay), Uruguay.

DISTRIBUTION.—Gulf of St. Lawrence to Florida, Gulf of Mexico (Florida to Mexico), West Indies (Puerto Rico, in mangroves), Central America (both sides Panama), South America (El Salvador, Venezuela, Uruguay), central California (San Francisco Bay and its estuaries; brackish water of Lake Merritt), Denmark, North Sea, English Channel, western Baltic to south coast of Spain, Mediterranean, Adriatic, West and South Africa. In high intertidal to 25 fathoms; sexual epitokes at surface.

Nereis (Neanthes) virens Sars, 1835

FIGURE 44*f*

Nereis virens Turnbull, 1876, p. 265, pls. 42–44.—Webster, 1879, p. 235.—Verrill, 1881, pp. 290, 296, 297, 300, 304, 308.—Webster and Benedict, 1884, p. 717; 1887, p. 724.—Bumpus, 1898a, p. 485.—Hamaker, 1898, p. 89, pls. 1–5.—Gray, 1900, p. 308.—Whiteaves, 1901, p. 81.—Sumner, Osburn, and Cole, 1913, p. 620.—Fauvel, 1923, p. 348, fig. 134,*g–k*.—Copeland and Wieman, 1924, p. 231.—Prefontaine, 1932, p. 207.—Procter, 1933, p. 139.—Miner, 1950, p. 317, pl. 103, pl. VII, 2, VIII, 3.—Pratt, 1951, p. 330.—Wesenberg-Lund, 1951, p. 42; 1958, p. 27.—Gustafson, 1953, p. 3.—Nicoll, 1954, p. 69, figs. 1–3.—Berkeley and Berkeley, 1954, p. 458.—Newell, 1954, p. 334.—MacPhail, 1954, p. 11, figs. 1–2.—Dow and Wallace, 1955, p. 1.—Pettibone, 1956a, p. 556.—Jørgensen and Dales, 1957, p. 357.—Stickney, 1959, pp. 14, 15.—Clark, 1960, p. 19.

Nereis (Neanthes) paucidentata Treadwell, 1939b, p. 6, fig. 25 (type from Charlestown, Massachusetts, examined, courtesy American Museum Natural History).—Not Moore, 1903a.

Nereis (Neanthes) varia Treadwell, 1941, p. 3 (new name for *N. paucidentata*, preoccupied).

Nereis southerni Abdel-Moez and Humphries, 1955, p. 147, figs. 1–6.—Rasmussen, 1956, p. 59.

Nereis riisei Hartman, 1956, p. 279 (part; includes *N. varia* Treadwell from Charlestown, Mass.).—Not Grube, 1856.

DESCRIPTION.—Length up to 900 mm., width up to 43 mm., segments up to 200 or more. Body thick anteriorly, somewhat flattened posteriorly, integument wrinkled. Tentacular cirri slender, tapering, the longest extending to setigers 3–9. Parapodia vary only slightly from anterior to posterior end (fig. 44*f*). Notopodium with 3 ligules, upper one largest, widest basally, tapering gradually to bluntly conical tip (largest in middle of body, decreasing slightly anteriorly and posteriorly); lower one shorter, conical; middle or presetal one still shorter, rounded (shorter and curved ventrally in middle and posterior segments). Setigerous lobe of neuropodium with a short rounded presetal lip and a longer fingerlike postsetal lip or ligule, with a lower conical ligule. Dorsal and ventral cirri shorter than the ligules. Acicula black.

Notosetae consist of homogomph spinigers. Upper bundle of neurosetae consist of homogomph spinigers and heterogomph falcigers with long blades; lower bundle of neurosetae consist of heterogomph spinigers and falcigers with long blades. Neuropodial heterogomph falcigers usually absent in the middle and posterior segments (may be present throughout in young specimens). Proboscis with black to dark amber-colored jaws, each with 5–10 teeth.

Paragnaths variable in color, number, size and arrangement; they may be black to light amber colored, rarely represented by papillae only on some areas. There may be several small paragnaths instead of a single large one. They may be conical, pointed to low, flat. Area I with 0–7 denticles; area II, arched groups (1–8); area III, irregular transverse group of 2–3 irregular rows (4–14); area IV, arched groups (5–27); area V, 0–4; area VI, 0–5; areas VII–VIII, irregular transverse band of 2–3 irregular rows.

Color, in life: iridescent greenish to bluish, with or without golden yellow or red spots scattered along middorsal line and on parapodia, some with whitish spots; greenish brown with scattered opaque whitish spots, more concentrated along prostomium and middorsal line; dark brown, cupreous.

The mature sexual forms develop into a slightly modified heteronereis. The eyes become slightly larger and more bulging. The first 7 pairs of dorsal cirri become cylindrical with curved tips (on males only?), the first 5 pairs of ventral cirri become slightly modified. The anal segment becomes crenulate. The body is not sharply set off into regions although the segments are more compressed in posterior two-thirds of body, and the parapodia are provided with a modified type of swimming setae in addition to the normal type of setae, i.e., they do not replace the normal type of setae, as in a well developed type of heteronereis. The swimming setae have a flattened blade, tapering abruptly to a short pointed tip. In the larger form swarming at the surface (270 mm. long, 25 mm. wide, 148 segments, Cape Cod Canal, Massachusetts, May 2 and 17, 1954), the parapodial lobes, especially the large upper dorsal ligules, start enlarging around segment 22, gradually enlarge to the middle of the body, then decrease gradually in size; the paragnaths on the proboscis were degenerate, mostly just amber-colored spots indicating the areas of the paragnaths.

Biology.—*Nereis virens*, commonly known as "clam worm" or "sandworm," is found in the sheltered shores of both sounds and estuaries, burrowing near the low water mark of the sandy and muddy shores and considerable distance farther up, where it ranges nearly to the top of the high water mark. It is especially common in flats bordering the mouths of rivers. It is found in all types of soils, including coarse and fine muddy sand, gravelly sand, in clay, peat, in water soaked wood. On rocky shores, it is found under rocks, stones, in the sand among mussel beds. It is found among the roots of decaying marsh grass and eelgrass. It is rarely found in scrapings from floats, pile scrapings among tunicates, sponges, barnacles, etc. It was found at only 2 stations in connection with the oceanographic fouling studies in the New England region.

It burrows at depths of from 7 to 45 cm., the largest specimens usually found at the greatest depths. It secretes a viscid fluid which binds the grains of sand together, forming a loose and flexible, irregular burrow. The abundant mucuslike secretion gives smoothness and some coherency to the walls of the burrow, but it does not form a solid tube. It feeds with the anterior end protruding out of the burrow, crawling to the food, seizing it with its powerful jaws and jerking it down into its burrow. It may show circular searching movements of the anterior end, when it is stimulated by food juices.

It comes out at times from the burrow, especially at night, to forage on the surface and swims about at the surface of the water. It is very active, swift, voracious and predatory, feeding on other worms and various kinds of marine animals; it also feeds on algae (*Ulva*). It has a keen sense of food detection (Copeland and Wieman, 1924) and will respond to most minute particles of ground clam meats. Chemical sense is the primary one upon which its responses to animal food depend, sight playing little part in the worms' food reactions. It can be induced to enter glass tubes of appropriate diameter, placed in sea water; the tubes are soon lined with mucus; it will behave essentially as it does in its natural burrows in the sand. There is a rhythmic undulatory movement of a variable portion of the body, taking place in a dorsoventral direction, these muscular waves producing a current of water passing along the body from the anterior to the posterior end. The current of water in the burrow would bring in a constant supply of fresh water as well as be a factor in conveying food stimuli to the sense organs.

It is capable of considerable migration. The worms have been observed moving along drainage channels with the incoming tide, along the surface of the flats for as much as 12 feet before reburrowing in the flats (Dow and Wallace, 1955). Young worms, up to 60 65 segments, were gathered at night, swimming at the surface (Eel Pond, Woods Hole, Massachusetts, June 27, 1954).

The worms are dug out by the tautog, scup, and other fish and, being one of the largest and most abundant of polychaetes in the New England region, form an important item of food for many fish. They are used extensively as bait by line fishermen. Along with the blood worms, *Glycera*, they are of commercial importance for the United States salt-water sport fishery which extends from Connecticut to

Maryland, with greatest concentration in waters about Long Island. Maine has been the heavy producer for the past 20 or more years; since 1949, they have been dug commercially in Canada. In the years 1946 to 1954 in Maine, on the average 123,308 pounds, with a yearly value of $76,986.00 were marketed (Dow and Wallace, 1955).

To be of commercial importance, the worms have to be at least 20 cm. long (about 8 inches). They are collected in wooden boxes and shipped by air express in a moist fibrous type of seaweed which is found in the salt marshes of Nova Scotia (*Ascophyllum mackaii* and *A. nodosum*). It is generally believed that they reach minimum marketable size sometime after their first year, and that the larger worms taken in the commercial fishery are probably in their third year. They are thought to carry out their spawning effort toward the end of their third year. After spawning, all or nearly all of the spent spawners die.

During the reproductive season, the sexually mature adults leave their burrows and swim at the surface; they have been observed swimming in shallow waters along the shores, in tide pools, sometimes swarming in immense numbers both in the daytime and evening; sometimes scores of spent males are observed. They emerge from the mud or gravel as the tide rises, then disappear again. In Maine they have been observed swarming in the middle of March to late in June, sometimes extending into August (Gustafson, 1953). In New Hampshire at Emerson Beach, mouth of Oyster River, swarming of spent males were observed in April (April 11, 1955, E. Swan; up to 160 mm. long, 13 mm. wide, 135 segments). In Massachusetts, the height of the breeding season appears to be in March (Bumpus, 1898a; Gray, 1900). Some sexually mature slightly modified heteronereids were found swimming in tide pools at Scituate in April (April 2, 1957, J. E. Hanks).

The swarming of smaller worms (about 180 mm. long, 11 mm. wide) was observed by Mr. Milton Gray at Barnstable from the end of February to the first of April, the worms swimming close to the flats at half tide to low tide; Mr. Gray also observed larger ones (up to 270 mm. long, 25 mm. wide) along the Cape Cod Canal in May (May 2 and 16, 1954; May 5-8 and 19-22, 1955; May 8-10 and 23-26, 1956), the worms swimming at the surface in the evening shortly before or after the change of tide during the new moon and full moon. In Rhode Island they have been observed in March and April (Bumpus, 1898a, Verrill and Smith, 1874); some sexually mature adults were found at Sakonnet Point, swimming about in tide pools (March 16, 1957, J. E. Hanks). At Whitstable, England, they spawn during spring tides in the middle of April, when swarms of adults become pelagic (Newell, 1954).

The worm has considerable powers of dispersal as indicated by its daylight crawling on exposed intertidal areas, its nocturnal swimming, and the swarming and spawning during the reproductive period. It swims actively and is carried by winds, tides, and currents, and dispersed over wide areas. It can withstand considerable changes in salinity from strictly marine to estuarine conditions. It has been collected high intertidally and dredged down to 84 fathoms.

MATERIAL EXAMINED.—Numerous specimens Gulf of St. Lawrence (Bay of Chaleurs, St. Lawrence estuary, Anticosti Island), Nova Scotia (Bay of Fundy), Newfoundland, New Brunswick (Harvey in Salisbury Bay, St. Andrews, Grand Manan), Maine (St. Croix River, Machias Bay, Penobscot Bay, Boothbay Harbor region, Casco Bay, Sea Point near Kittery), New Hampshire (Oyster River, Belamy River, Little Harbor, Sagamore Creek, Rye Harbor, Hampton Harbor), Massachusetts (Plum Island, Essex, Marblehead, Scituate, Annisquam River, Cape Ann, Woods Hole region, Megansett estuary, Elizabeth Islands, Martha's Vineyard, Cape Cod), Rhode Island (Narragansett Bay, Green Pond, Potters Pond, Sakonnet Point).

DISTRIBUTION.—Iceland, Norway, Ireland, North Sea to France, Gulf of St. Lawrence, Newfoundland to Virginia. Low water to 84 fathoms; sexual forms at surface.

Nereis (Hediste) diversicolor O. F. Müller, 1776

FIGURE 44,*g,h*

Nereis diversicolor ? Hoagland, 1919, p. 574.—Fauvel, 1923, p. 344, fig. 133,*a–f*.—Dehorne, 1925, p. 1141.—Herpin, 1926, pp. 18, 28, 88, 94, 118.—Thorson, 1946, p. 65, fig. 30.—Harley, 1950, p. 734.—Dales, 1950, p. 321; 1951, p. 131.—Wesenberg-Lund, 1950a, p. 56; 1950b, p. 42; 1951, p. 41; 1958, p. 26.—Smidt, 1951, p. 48, figs. 17, 18.—Wells and Dales, 1951, p. 674.—Newell, 1954, p. 334.—Dales and Kennedy, 1954, p. 699.—Boguchi, 1954, p. 79.—Smith, 1955a, p. 33; 1955b, p. 326; 1955c, p. 453; 1956, p. 81; 1958, p. 60.—Berkeley and Berkeley, 1956b, p. 267, fig. 3.—Jørgensen and Dales, 1957, p. 357.—Stickney, 1959, pp. 17, 18.—Clark, 1960, p. 19.

Neanthes diversicolor Hartman, 1960a, p. 35 (part).

DESCRIPTION.—Length up to 200 mm., width up to 10 mm., segments up to 120. Body thickened, turgid anteriorly, flattened posteriorly. Tentacular cirri slender, tapering, longest extending to setigers 5–7. Parapodia differ only slightly from anterior to posterior end. In the anterior segments (fig. 44*g*), parapodia with 3 notopodial ligules, upper one larger, triangular; lower one shorter, conical; middle or presetal one still shorter, conical. Setigerous lobe of neuropodia with two thick lips, postsetal lip or ligule slightly longer, conical; presetal lip short, bluntly rounded, with a conical lower ligule. Notosetae homogomph spinigers. Upper group of neurosetae homogomph spinigers and heterogomph falcigers with rather long blades;

lower group of neurosetae heterogomph spinigers and falcigers. Parapodia from middle of body with lips of neuropodial setigerous lobe subequal in length, not extending beyond the aciculum.

In the posterior parapodia, the middle or presetal notopodial ligule is small or absent. The setae are similar to the more anterior segments except that in the upper group of neurosetae, there are homogomph spinigers and few (1–3) heavy, specialized falcigers with endpieces completely or partially fused to the shafts (fig. 44*h*). Acicula dark to black. Dorsal and ventral cirri shorter than the ligules. Proboscis with brown amber-colored jaws, each with 5–8 teeth; with amber-colored paragnaths: Area I with 0–9 denticles; areas II and IV, arched groups; area III, transverse mass of 2–3 irregular rows; area V, 0; area VI, 1–9; areas VII–VIII, wide scattered band of 1–2 irregular rows.

Color, in life: very variable, as indicated by its specific name, greenish, yellowish, yellowish green, orange red, reddish brown, with 2 darker longitudinal bands; may have yellowish pigment on prostomium; colorless preserved, except for 2 faint to distinct longitudinal bands in the anterior region. Dales and Kennedy (1954) found that the variable color is due to variations in the proportion of green, orange, and brown pigments and that the green pigment is due to biliverdin in minute granules in the epithelial cells under the cuticle, mainly along the borders of the blood capillaries, formed by the breakdown of hemoglobin of the blood. The yellow, brown, and orange pigments were mainly carotenoids. They found that the entirely green form consisted of ripe males (bright grass green), ripe females (darker green), and spawned females. As the worms mature, the tissues undergo phagocytosis, the muscles of the body wall are eroded away, and the amount of hemoglobin diminishes; the biliverdin is derived from the hemoglobin. The females are more variable in color—green with orange or brown pigments. When they spawn, they lose the orange and brown pigments and become uniformly green. Heteronereis stage is lacking. They may be found filled with rather large yolky eggs.

BIOLOGY.—*Nereis diversicolor* is almost entirely restricted to the littoral zone. It is one of the commonest of all shore polychaetes in the British Isles and northwestern Europe. It is highly euryhaline, easily adapting itself to salt water in the littoral region, to brackish water, and to salt swamps of varying salinites. In the coastal areas, it is especially common where there is a large admixture of fresh water. Smith (1955a–c, 1956) found that when in an essentially "marine-dominated" environment, *N. diversicolor* finds its optimum in local, relatively brackish zones; that the brackish intertidal water is a characteristic and relatively stable feature; and that it is found in the least saline part of the available habitat.

In estuaries where the worms are subject to wide salinity variations semidiurnally, semimonthly and seasonally, it may withstand ranges of salinities from over $25^0/_{00}$ or more down to salinities below $1^0/_{00}$. In British estuaries, it penetrates farther into waters of low salinity than any other "marine" type and may penetrate into nearly fresh waters. In stable waters of low salinity, as in the practically tideless Baltic Sea, it is found subtidally in shallow waters and encounters over much of the year a low but relatively stable salinity; here it appears to be limited to a salinity as high as $4^0/_{00}$.

Smith (1955c) made a comparative study of *N. diversicolor* from representative parts of its geographical range, under 4 different types of salinity: (1) That of relatively stable high salinity of marine-dominated population in Scotland and southern England; (2) relatively stable low salinity of Baltic population in Gulf of Finland; (3) varying salinities or estuarine conditions in southern England; and (4) intermediate salinities in Denmark. He carried out ecological and physiological studies in several localities in respect to salinity tolerance and found that *N. diversicolor* shows a uniform pattern of constant level of coelomic chloride regulation relative to salinity of the medium regardless of the salinity of its regional background and that there are no physiological races in respect to salinity tolerance. *N. diversicolor* behaves as a typical adjustor in higher salinities but as a regulator in lower salinities. Having long survived under conditions of practically complete oxygen lack, it has great powers of osmoregulation; it also has a wide temperature tolerance.

It is found on bottoms of mud, clay, coarse and fine muddy sand, fine gravelly sand, peat, among the roots of marsh grass. It is found in coarse sand of exposed beaches as well as in fine firm mud of protected shores. It forms fairly permanent burrows, which may be a simple vertical U-shaped gallery or complicated by the presence of additional branches with openings to the surface. According to Smidt (1951) and others, although it tolerates very different conditions of life, it seems to show a certain preference for the upper part of the tidal zone and for a soft bottom; it thrives best where the bottom is sheltered against too heavy movements of the water. It feeds on algal fragments, dead crustaceans or molluscs, etc., and swallows the surface mud around the openings of the burrow.

According to Boguchi (1954), it is an omnivorous animal, eating algae, mud, and vegetable and animal detritus; cannibalism was frequently observed. The worms pull out of their burrows and brouse on the surface of the mud. Herpin (1926) found that it feeds on *Enteromorpha*, *Porphyra*, diatoms, *Zostera*, and, at certain seasons when the marine algae is not available, on debris and terrestrial vegetation brought down to the sea; at certain seasons, it may be carnivorous, feeding on other annelids. On breaking the clods of mud, one may find that the walls of the galleries are filled with fragments of *Enteromorpha* or *Zostera;* the animal drags fragments of the algae into the galleries for feeding later.

Harley (1950) found that it is able to use a filter-feeding mechanism, at least when occupying glass tubes in the laboratory. A filter-feeding funnel, attached in front to the wall of the tube, was made from long threads secreted by the parapodial glands and molded into the shape of a funnel by the parapodial setae. With the undulation of the segments of the body, water with the suspended particles was drawn past the animal anteroposteriorly; particles were sieved out of the water current. At intervals, the worm moved forward and swallowed the feeding funnel with its entrapped particles.

Dales (1950, 1951), in a study of a population in the Thames estuary in England, and others have found that the sexual adults are atokous (the reports that they may be epitokous are probably due to confusion of species; the closely related *N. japonica* Izuka in Japan swarms at the surface, without, however, going through the marked structural changes of the typical heteronereid; it is only slightly modified, Smith, 1958) and dioecious (some consider that hermaphroditism might occur exceptionally; the closely related *N. limnicola* Johnson, which includes *N. lighti* Hartman, from California estuaries and fresh water lakes, is a protandrous, self-fertilizing viviparous hermaphrodite, Smith, 1950, 1958). The males are fewer in number than the females (only 10 percent males found by Dales; 40 percent males found by Boguchi, 1954). Under natural conditions both Deherne (1925) and Dales (1950) have described a kind of pseudocopulation or sexual congress in which several females were found around a single male, associated perhaps with the scarcity of males. Herpin (1926) found 1 male to 7 females. In this case, the usual procedure is reversed and the numerous females pursue the scarce males. They may leave their burrows at night and swim in search of males.

Spawning takes place in the burrow. Dales observed that spawning took place toward the end of February when there was a marked rise in temperature between 5° and 8.8° C. Spawning occurs mostly in late winter or early spring but may occur exceptionally throughout the year in parts of its range. The eggs are evidently shed by rupture of the body wall. The sperm are discharged through the nephridia or by rupture of the body wall. Females die after spawning. Owing to the comparative scarcity of males and the fact that the females will not spawn except in the presence of a male, large numbers of mature females remain unspawned. They eventually die before the following spawning season but may attain a relatively large size before doing so; thus they may attain a length of 200 mm. The length of life does not normally exceed 18 months and includes only 1 breeding season.

The early development has been followed by Dales (1950). The eggs are lecithotrophic. The larvae develop in the mud and there is no true pelagic phase, although young individuals may be whirled up in the water and thus be found in the plankton. They developed into ciliated monotrochophores, then into free-swimming larvae with limited swimming powers. By 7 weeks they were 1.6 mm. long, with 10 setigerous segments, and feeding began. During the first 8 weeks, the larvae developed in the parent burrow and by 10 weeks were 4 mm. long, with 20 setigers, and pigmented. They were miniature adults, burrowing in the mud and constructing minute U-shaped tubes. The worms grew rapidly and steadily increased in length during the first summer after hatching, increasing 10–20 mm. in length each month; young worms hatched in February reached a length of 100 mm. by October. During the winter months, there was little or no increase in length. The germ cells grew rapidly during this period. By October in the female, the coelom contained small oocytes; the coelom became filled with a loose parenchyma tissue which appeared to be responsible for the growth and deposition of yolk in the oocytes. The loose parenchyma disappeared and mature oocytes came to fill most of the coelom. In the male, the loose parenchyma soon disappeared; "sperm-plates" formed and acquired tails; free sperm were found in the coelom for two weeks before spawning. In both sexes, histolysis of the muscle layers of the body wall took place and it became very thin by the time spawning was ready to take place.

Boguchi (1954) cultivated *N. diversicolor* in the laboratory aquarium (temperature 15° to 20° C.). They reached sexual maturity and reproduced in the spring breeding season; young animals 6 months old reached the length of the adult animal (about 100 mm.).

Material examined.—Numerous specimens from Gulf of St. Lawrence (Bay of Haha, Saguenay River, St. Lawrence estuary, Cascapedia River, Port Daniel, New Richmond, Bay of Chaleurs), Nova Scotia (shore opposite Five Islands, east side Cape George, Delap Cove, Kingsport), New Brunswick (New Horton), Maine (Starboard Creek in Machias; Drummore Bay at Phippsburg; Robbinston on St. Croix River; Boothbay Harbor region, Sheepscot and Cod Cove, Sheepscot River, off Merrill Ledge, North Edgecomb, Fort Popham; gut between Sawyer and Barter Islands, cove south shore Sawyer Island, Sagadahoc Bay and Riggs Cove, Georgetown Island, Medomak; Bradstreet Cove off Poorhouse Cove, John's River), New Hampshire (Oyster River just below dam in stream bed; Beard's Creek emptying into Oyster River near Durham, Emerson's

Beach, mouth of Oyster River, mud by Bellamy River; Hilton Park, Dover Point, Wentworth, north shore Little Harbor; Fort Stark, Newcastle; Hampton Harbor near entrance to Blackwater River), Massachusetts (Beverly Harbor, M. Gray; Annisquam River, Cape Ann, R.W. Dexter).

DISTRIBUTION.—Greenland, Iceland, Norway to English Channel, North Sea, Baltic, Mediterranean, Adriatic, Gulf of St. Lawrence to Massachusetts (Cape Ann), Puerto Rico(?). High intertidal to 22 fathoms.

Nereis (Nereis) pelagica **Linné, 1758**

FIGURE 42,*d–h*

Nereis pelagica Verrill, 1881, pp. 288, 290, 293, 294, 295, 296, 297, 301, 308, 311, 315, 316, 324.—Webster and Benedict, 1884, p. 718; 1887, p. 724.—Whiteaves, 1901, p. 80.—Sumner, Osburn, and Cole, 1913, p. 619.—Fauvel, 1923, p. 336.—Herpin, 1926, pp. 15, 18, 29, 43, 59.—Wilson, 1932, p. 203, figs. 1–12.—Procter, 1933, p. 139.—Thorson, 1946, p. 64, fig. 29.—Miner, 1950, p. 318, pl. 103.—Pratt, 1951, p. 330.—Grainger, 1954, p. 514.—Pettibone, 1954, p. 264, fig. 30,*a–b;* 1956a, p. 557; 1956b, p. 290.—Uschakov, 1955, p. 211, fig. 66.—Rasmussen, 1956, p. 53, figs. 17–18.—Jørgensen and Dales, 1957, p. 358.—Wesenberg-Lund, 1958, p. 26; 1962, p. 76.—Rioja, 1958, p. 253.—Clark, 1959, p. 85; 1960, p. 19.—Fauvel and Rullier, 1959, p. 572.

DESCRIPTION.—Length up to 155 mm., width up to 14 mm., segments up to 100. Body slender, trim, with integument smooth, not wrinkled. Tentacular cirri rather short, subequal, longest may reach setiger 2, with a tendency to be somewhat articulated distally. Parapodial lobes (fig. 42*d*) similar throughout the body. Notopodium with 2 subequal, short, thick, bluntly rounded ligules (subconical in posterior region and in young specimens), between which is an inconspicuous setigerous lobe. Neuropodium with bluntly conical setigerous lobe and a lower ligule which is similar to the notopodial ligules. Dorsal and ventral cirri longer than the ligules.

In the anterior region, notosetae homogomph spinigers (fig. 42*e*). Upper group of neurosetae homogomph spinigers and heterogomph falcigers; lower group of neurosetae heterogomph spinigers (fig. 42*f*) and falcigers with short blades (fig. 42*g*). In the middle and posterior regions, notosetae consist of few (4 or so) homogomph falcigers with reduced blunt blades (fig. 42*h*; begin on about setiger 40). Neurosetae similar to the anterior region except some of the falcigers may lose their blades and give the appearance of simple setae.

Acicula black. Proboscis with black jaws, each with 5–7 teeth; with paragnaths: area I with 1–3 denticles; areas II and IV, arched groups of 2–3 rows; area III, small transverse groups of 2–3 rows; area V, 0 (rarely 1–3); area VI, usually 4 larger ones in square or cross (2–8); areas VII–VIII, 1–2 irregular rows of quite large paragnaths, followed by several rows of smaller ones which diminish in size posteriorly.

Color, in life: iridescent greenish brown, rich golden brown, reddish brown, light brown, olive green, yellowish, violet; color, preserved: uniformly purplish, reddish, some with dorsal cirri and ligules dark distally.

At maturity, sexually dimorphic heteronereids are formed. The eyes are greatly enlarged. The body is divided into 2 regions, anterior region with the usual type of setae and posterior region with the usual type of setae replaced by swimming setae, segments compressed and flattened anteroposteriorly, with extra development of lamellar plates on neuropodia and bases of dorsal and ventral cirri.

Table 3 below shows how the sexually dimorphic males and females differ.

TABLE 3.—*Differences between sexually dimorphic males and females in* N. (Nereis) pelagica

Character	*Male heteronereid*	*Female heteronereid*
Dorsal cirri of anterior region	First 7 pairs enlarged, cylindrical, with curved tip	First 5 pairs slightly modified
Ventral cirri of anterior region	First 5–6 pairs modified, clubbed	First 4 pairs slightly modified
Number of setigers in anterior region	16	15–19
Dorsal cirri of posterior modified region	Crenulate on lower margin	Smooth, not crenulate
Pygidium or anal segment	Papillate or crenulate	Smooth, not papillate

BIOLOGY.—Found intertidally on rocky shores, under rocks, in crevices, among mussels (*Mytilus*) and sponges (as *Halichondria*), on algae, including holdfasts of *Laminaria*, under incrusting algae (as *Lithothamnion*) on rocks. Confined mostly to the lower half of the intertidal zone. Found on pilings, floats, among tunicates, sponges, hydroids, etc. May form membranous tubes attached to algae. Found on floating kelp and sometimes washed upon the beach after storms along with the kelp (as *Laminaria, Fucus*). Very numerous in the oceanographic fouling studies in the New England region. Dredged on bottoms of sand, gravel, stones, rocks, rarely in mud, among shells, bark, algae (including "weed" from Lagoon Pond), sponge masses, bryozoan nodules, compound tunicates (as sandy *Amaroecium pellucidum*), corals, and worm tubes. The species is characteristically found in clean, fresh, circulating water. Taken from the Atlantic cod *Gadus callarias* (Grainger, 1954) and from the stomach of haddock (Georges Bank, 1953, 1954, R. Wigley). Four male heteronereids were taken from the stomach of herring in the Gulf of St. Lawrence.

Sexual epitokes appear sporadically at varying times of the year and may appear in surface waters. They have been reported in December to January in the English Channel, April to May and October near Iceland, in August in Norway (Wilson, 1932; Thorson, 1946), in April in Denmark (Rasmussen, 1956), in July and August in Canadian Arctic (Grainger, 1954). They were found in Labrador in August (60 fathoms), Woods Hole, Massachusetts in March (surface), Cape Cod Canal in May (surface), and vicinity of Eastport and Penobscot Bay and Mount Desert region in October (1 to 30 feet). Wilson (1932) followed its early development and found it to have pelagic larvae.

Material examined. — Numerous specimens from Labrador, Gulf of St. Lawrence, off Newfoundland, Nova Scotia, New Brunswick, Maine (vicinity Eastport, Mount Desert region, Penobscot Bay, Rockland, Muscongus Bay, Boothbay Harbor region, Sea Point near Kittery, Cape Neddick, York), New Hampshire (Isles of Shoals, Fort Stark, Newcastle, Rye Harbor, Hampton Harbor), Massachusetts (Georges Bank, Beverley, Cape Ann, Cape Cod, Martha's Vineyard, Elizabeth Islands, Vineyard Sound, Buzzards Bay, Nantucket), Rhode Island (Narragansett approaches), Connecticut, Long Island Sound, in low water to 250 fathoms; sexual forms at surface.

Distribution.—Widely distributed in the Arctic. Also Iceland, Norway to Mediterranean, Azores, West Africa, Hudson Bay to Long Island Sound, Florida (Key Largo), Bering Sea to Panama, Mexico, north Japan Sea to Japan, South Atlantic (Tristan da Cunha, Kerguelen, Magellan Straits). In low water to 609 fathoms; sexual heteronereids at surface.

Nereis zonata Malmgren, 1867

Figure 42c

? *Nereis tenuis* Webster and Benedict, 1884, p. 718, pl. 3, fig. 37, pl. 4, figs. 38–43.—Miner, 1950, p. 318, pl. 104.

Nereis zonata Fauvel, 1923, p. 338, fig. 130,*g–n* (part).—Pettibone, 1954, p. 265, fig. 30,*c,h–i;* 1956a, p. 557.—Uschakov, 1955, p. 212, fig. 66.—Eliason, 1962, p. 250.

Description.— Length up to 125 mm., width up to 7 mm., segments up to 100 or more. Body slender, cylindrical, with integument smooth, not wrinkled. Tentacular cirri rather short, subequal, longest may reach setiger 2. Parapodia (fig. 42*c*) similar throughout the length of the body. Notopodium with 2 subequal, triangular to conical ligules, gradually tapering to a broad tip. Neuropodium with conical setigerous lobe and a lower ligule similar to the notopodial ligules. Dorsal cirri longer than the ligules; ventral cirri equal to or slightly shorter than the ligules.

In the anterior region, notosetae consist of homogomph spinigers. Upper group of neurosetae, homogomph spinigers and heterogomph falcigers; lower group of neurosetae, heterogomph spinigers and falcigers with rather short blades. In the middle and posterior regions, notosetae consist of few (1–3 or so) homogomph falcigers with short, blunt oval blades (begin on about setiger 30). Neurosetae similar to anterior region except some of the heterogomph falcigers may lose their blades and give the appearance of simple setae. Acicula black. Proboscis with falcate jaws, each with 6–7 teeth; with paragnaths: area I with 0–1 denticles; areas II and IV, arched masses of 2–3 rows; area III, small transverse group of 2–3 rows; area V, 0 (rarely 1); area VI, oval mass (6–10 or more); areas VII–VIII, a row of quite large paragnaths (7–9) anterior to a wide band of small subequal ones.

Color: faint to dark wide transverse bands of reddish, rusty brown, violet, purple red (anterior fourth of segment without color); or without color on smaller specimens.

At maturity, sexually dimorphic heteronereids are formed. The eyes are greatly enlarged. The body is divided into two regions, an anterior region with the usual type of setae, and a posterior region with the usual type of setae replaced by swimming setae, with segments compressed and flattened anteroposteriorly, with extra development of lamellar plates on neuropodia and bases of dorsal and ventral cirri. Table 4 below shows how the sexually dimorphic males and females differ.

TABLE 4.—*Differences between sexually dimorphic males and females of* N. zonata

Characters	*Male heteronereid*	*Female heteronereid*
Dorsal cirri of anterior region	First 7–8 pairs clubbed	First 7 pairs slightly or not modified
Ventral cirri of anterior region	First 5–7 pairs clubbed	Not modified?
Number of setigers in anterior region	14–17	16–17
Dorsal cirri of posterior modified region	Crenulate on lower margin	Smooth, not crenulate

Biology.—Dredged on bottoms of shells, sand, and gravel. Appears to be a cold water Arctic form. Sexual epitokes appear sporadically.

Material examined.—Few small specimens from Massachusetts (Cape Cod Bay near Cape Cod Canal and off Provincetown, off Martha's Vineyard), in 10–75 fathoms.

Distribution.—Widely distributed in the Arctic. Also Iceland, Faroes, Denmark, Hudson Bay to Massachusetts (Cape Cod), Bering Sea to Oregon, north Japan Sea. In low water to 439 fathoms; heteronereids at surface.

***Nereis (Nereis) grayi* Pettibone, 1956b**

Figure 42*i*

Nereis (Nereis) grayi Pettibone, 1956b, p. 282, fig. 3.

Description.—Body long, slender. Tentacular cirri long, tapering, the longest extend to setiger 6. Parapodia similar throughout the length of the body. In the anterior region, notopodium with 2 subequal, elongated, conical, sharply pointed ligules. Neuropodium with bluntly conical setigerous lobe and lower, slightly shorter ligule. Notosetae consist of homogomph spinigers. Upper group of neurosetae consist of homogomph spinigers and heterogomph falcigers; lower group of neurosetae consist of heterogomph spinigers and falcigers with rather long blades. In the middle and posterior regions, the setae are similar except that the notosetae consist of a few (1–2) homogomph falcigers with short, oval blades (begin on about setiger 27). Acicula dark. Dorsal and ventral cirri shorter than the ligules. Proboscis with brown amber-colored jaws; without paragnaths on areas I, III, V, VII–VIII; with paragnaths few and small on the other areas; area II with 2–3 denticles; area IV, triangular group of 10–13; area VI with 3–4 denticles. Colorless preserved. Sexual epitokes unknown.

Biology.—Found in mud, in elongate mud tubes of the maldanid *Maldanopsis elongata* (Verrill). Dredged in about 10 fathoms on bottoms of silty clay, fine sand (the maldanid was also common Buzzards Bay, H. Sanders).

Material examined.—Few specimens from Massachusetts (Hadley Harbor, Uncatena Island, M. Gray; Buzzards Bay, about 10 fathoms, H. Sanders).

Distribution.—Massachusetts (Woods Hole region). Low water to 10 fathoms.

Family Paralacydoniidae, new family

Type genus: *Paralacydonia* Fauvel, 1913.

Paralacydonia Fauvel has been placed, along with *Lacydonia* Marion and Bobretzky, in the subfamily Lacydoniinae under the Phyllodocidae by Saint-Joseph (1888) and Fauvel (1914, 1923). *Lacydonia* seems to show a closer relationship to the Phyllodocidae and Alciopidae, while *Paralacydonia* seems more closely related to the Nephtyidae. While increasing the number of polychaete families is not particularly desirable, it has certain advantages over too much lumping. Not much is to be gained by annexing a genus to a larger family where it has few characters in common, since the major differences of the aberrant genus are apt to be obscured in the larger, better known family.

The following species have been described under *Paralacydonia:* the type species, *P. paradoxa* Fauvel (1913, 1914) from the Mediterranean; *P. weberi* Horst (1923) from the Netherlands Indies; *P. mortenseni* Augener (1924) from New Zealand and referred later to *P. weberi* by Augener (1927). The 2 species are dredged forms and are similar in most respects. Uschakov (1958b) considers them to be a single species.

Body elongate, vermiform, subrectangular in cross section, having the general aspect of a nephtyid. Prostomium subconical, with 4 very small anterior antennae. Tentacular or buccal segment achaetous and without appendages. First setigerous segment uniramous, rest biramous, supported by acicula. Parapodia with rami well separated, with long cilia along interramal border (as in Nephtyidae); each ramus with somewhat flattened presetal and postsetal lobes (correspond to lamellae of Nephtyidae). Dorsal cirri small, conical; ventral cirri digitiform (cirri not leaflike as in Phyllodocidae or Lacydoniidae). Notosetae simple. Neurosetae all compound (*P. weberi*) or mostly compound with few lower simple setae (*P. paradoxa;* thus setae not all simple as in Nephtyidae). Proboscis muscular, cylindrical, unarmed.

Contains only one genus.

Genus *Paralacydonia* Fauvel, 1913

Type (monotypy): *Paralacydonia paradoxa* Fauvel, 1913. Contains only one New England species.

Paralacydonia paradoxa Fauvel, 1913

Figure 46

Paralacydonia paradoxa Fauvel, 1913, p. 54, fig. 10; 1914, p. 118, pl. 7, figs. 1–9; 1923, p. 198, fig. 74,*a–i*; 1936b, p. 24.—Uschakov, 1958b, p. 416, fig. 1.—Uschakov and Wu, 1959, p. 8. —Hartman, 1960b, p. 86, pl. 6.

Description.—Length up to 20 mm., width up to 1.5 mm., segments up to 70. Body elongated, slightly flattened, subrectangular in cross section. Prostomium (fig. 46,*a*,*b*) subconical, slightly flattened, without eyes, with 4 very small subequal anterior antennae (the antennae may be rather indistinct and easily overlooked). Buccal segment without appendages, ventrally forming lateral lips to the funnel-shaped mouth. First setiger uniramous, with bilobed presetal lip and single conical postsetal lip, with single bundle of compound setae; dorsal cirri rudimentary; ventral cirri cylindrical; ventrally forms lower lip of mouth.

Parapodia biramous, supported by acicula, with rami well separated, similiar along length of body, becoming thinner and more elongate posteriorly, with long cilia along the interramal parapodial border, forming

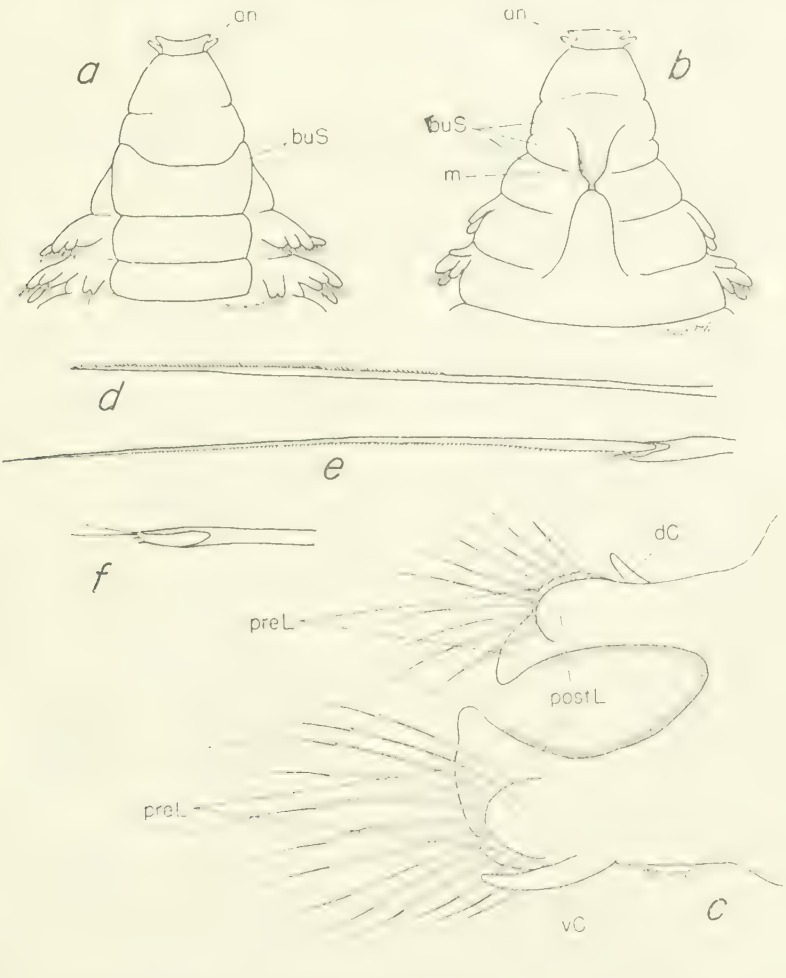

Figure 46.—Paralacydoniidae, *Paralacydonia paradoxa:* *a*, dorsal view anterior end; *b*, same, ventral view; *c*, left middle parapodium, posterior view; *d*, notoseta; *e*, spinigerous heterogomph compound neuroseta; *f*, distal tip of stem of same, with blade broken off.

a ciliated groove along the body. Middle parapodium (fig. 46*c*) with elongate notopodium with shorter rounded postsetal lip and unequally bilobed presetal lip, the upper part short, rounded and the lower part longer, papilliform, extending diagonally ventrally, with a fan-shaped bundle of slender notosetae. Notosetae (fig. 46*d*) simple, slender, finely spinous along slightly limbate border, tapering to fine tips. Dorsal cirri short, digitiform, emerging midway dorsally on notopodia.

Neuropodia slightly longer than notopodia, similar in shape except upper part of presetal lip is larger, subtriangular. With a fan-shaped group of neurosetae, few lower ones simple, shorter, similar to notosetae; rest of neurosetae (fig. 46,*e,f*) longer, compound spinigerous with stem heterogomph, spinous or frayed terminally, with blade long, tapering to capillary tips, finely spinous along one side. Ventral cirri cylindrical, extending distally to end of neuropodial lobe. Anal end without cirri (?). Colorless or with scattered brownish spots.

BIOLOGY.—Dredged on bottoms of mud, mud with sand, gravel, and broken shells.

MATERIAL EXAMINED.—Off Massachusetts (*Albatross* Station 2242, 40°15′ N., 70° 27′ W., 58 fathoms, 1884; Station 2248, 40°07′ N., 69°07′ W., 67 fathoms, 1884).

DISTRIBUTION.—Mediterranean, Atlantic off Morocco, off Massachusetts, Yellow Sea, off Southern California. In 27 to 1,030 fathoms.

Family Nephtyidae (=Nephthydidae)

Body elongated, linear, subtetragonal in cross section, with numerous short segments, tapered slightly anteriorly and more so posteriorly. Prostomium (fig. 49,*a,c,d*) small, somewhat flattened, angulate (subpentagonal, subrectangular, subquadrate). Four short, conical antennae present, an anterior pair at the anterior angles of the prostomium and a more posterior and slightly ventral pair (latter may be hidden as viewed dorsally; may be considered as ventral palps). A pair of nuchal organs at the posterolateral margins (inconspicuous ciliated sacs when inverted, appearing as a pair of papillae if everted). With or without eyes (often small, deeply buried, inconspicuous; according to Clark, 1956a, 1957, nearly all species of *Nephtys* possess a pair of eyes, each consisting of a pair of inverted single-celled photoreceptors which lie in pigment cups on the side of the brain; they are deeply embedded in the ganglion and, except in the small species, are not visible from the exterior; only the small species were able to orient themselves in a light beam).

First or tentacular segment extending lateral and ventral to prostomium, with reduced notopodia and neuropodia with setae, with a pair of ventral tentacular cirri lateral to the neuropodia, similar to the antennae, with or without a pair of dorsal tentacular cirri.

Ventral part of first five segments modified to permit passage of the large muscular proboscis, with muscular gular membrane folded and tucked within the lateral lips of the mouth.

Parapodia (fig. 51) biramous, with rami well separated, with acicular lobes flattened anteroposteriorly (supported by internal aciculum which may have tip curved or covered by pigmented chitinous plate) and bearing fan-shaped preacicular and postacicular groups of setae, with or without anterior and posterior lamellae (flattened plates anterior and posterior to the setae), usually with a curved ciliated branchia (sometimes referred to as interramal cirrus) between the rami on a certain number of segments. Branchiae may be cirriform, sickle-shaped or foliaceous, involute (curved inward, fig. 48) or recurved (curved outward, fig. 51). Dorsal cirri (sometimes referred to as branchial cirri) on the lower sides of the notopodia; ventral cirri on the lower sides of the neuropodia; dorsal and ventral cirri short, conical or foliaceous. Setae simple, cross-channeled or camerated, serrated, ending in fine capillary tips; some may be bifurcated (lyrate). Pygidium with a single anal cirrus.

Proboscis (fig. 49*b*) eversible, cylindrical, strongly muscular, bearing terminally soft papillae around the opening, usually ten pairs bifid papillae and two vertical lips, with a single middorsal and midventral papilla. Usually subterminal soft, conical papillae arranged in 14–22 longitudinal rows, with or without a longer middorsal or midventral papilla between the terminal and subterminal papillae. Basal part of proboscis smooth, ridged, or furnished with low tubercles or warts. A pair of horny hooked jaws within the proboscis, not visible unless dissected.

All the species in the family bear a superficial resemblance, associated no doubt with their living in a more or less uniform habitat. They burrow in sand, mud, or ooze from high intertidal levels to great depths. They are prominent members of shallow water and shore fauna. They are predatory and extremely lively and move rapidly. They are able to burrow rapidly in moist sand, but do not form permanent burrows. They swim by a rapid undulatory movement in a horizontal plane (they are referred to as shimmy worms). They may leave the substratum for spawning and other excursions and are active swimmers. In France, they are used as bait. They are sometimes called sand worms because of their frequent occurrence in sand. They are usually pearly or slate gray in life, with red middorsal blood vessel, red branchiae, red midventral streak (neural vessels lateral to ventral nerve cord; for details of blood vascular system of *Nephtys*, see Clark, 1956*b*).

The parapodial cilia have been studied by Coonfield (1931, 1934). The cilia on the parapodia are grouped into small tufts, in a single row beginning on the outside of the base of the branchia, continuing around the tip of the branchia, and on the inner side and extending on the body wall between the rami to the base of the neuropodium. The effective beat of the cilia is from the head end toward the tail end. A current of water flows on each side of the worm posteriorly in the groove between the parapodial rami. The metachronal wave of cilia is at right angles to their effective beat. This wave passes from dorsal to ventral on the right side of the worm and from ventral to dorsal on the left side. The metachronal wave of cilia shows a rhythmic movement. The beating of the cilia on the branchiae and body wall produces a current which carries liquids and other materials posteriorly along the body. This ciliary movement is independent of the nervous system.

In studies of the nervous system, Clark (1955, 1956*c*, 1957, 1958*a–c*) found that, in contrast to the relative uniformity of external morphology in the Nephtyidae, the nervous systems in the different species show many differences and may very well prove to be of important diagnostic value. The early planktonic stages of *Nephtys* sp. in Rhode Island were followed in part by Fewkes (1883, p. 180, pl. 4).

Key to the Known Genera of Nephtyidae

1. Parapodial lobes with lamellae lacking or rudimentary (fig. 47,*b*,*c*). **Micronephthys** (p. 188)
   Parapodial lobes with lamellae 2
2. Branchiae involute, curved or rolled in spiral inwardly toward lateral side of body (fig. 48,*a*,*b*,*d*) . . . . **Aglaophamus** (p. 190)
   Branchiae recurved, cirriform or foliaceous, with convex side toward lateral side of body (fig. 51) . . . . **Nephtys** (p. 193)

Genus *Micronephthys* Friedrich, 1939

Type (monotypy): *Micronephthys minuta* (Théel, 1879). Contains only one New England species.

Micronephthys minuta (Théel, 1879)

FIGURE 47,*b*,*c*

Nephthys minuta Théel, 1879, p. 28, pl. 2, fig. 18.—Annenkova, 1937, p. 164; 1938, p. 162.—Gorbunov, 1946, p. 38.—Uschakov, 1955, p. 217, fig. 68.
Micronephthys minuta Friedrich, 1939, p. 123, figs. 3–4.

DESCRIPTION.—Length up to 16 mm., width up to 3 mm., segments up to 30. Antennae subequal. Tentacular segment with prominent neuropodial conical setigerous lobes, with ventral tentacular cirri subequal to antennae. Notopodial setigerous lobes less prominent, without dorsal tentacular cirri. Parapodia (fig. 47,*b*,*c*) with rami widely separated, subequal, with rather sharply conical acicular lobes, without lamellae, with preacicular setae barred, longer than the rami.

Postacicular setae long, smooth. Dorsal and ventral cirri small, conical. Branchiae (fig. 47*c*) begin on setigers 10–14 (setiger 10, according to Théel; setigers 12–14 on specimens examined), few in number (?) (at least 8 pairs on specimens examined, none complete posteriorly, may be lacking according to Friedrich, 1939). Branchiae are cirriform and may be curled inward.

Biology.—A primitive type nephtyid dredged on bottoms of sand, muddy sand, mud, and globigerina ooze.

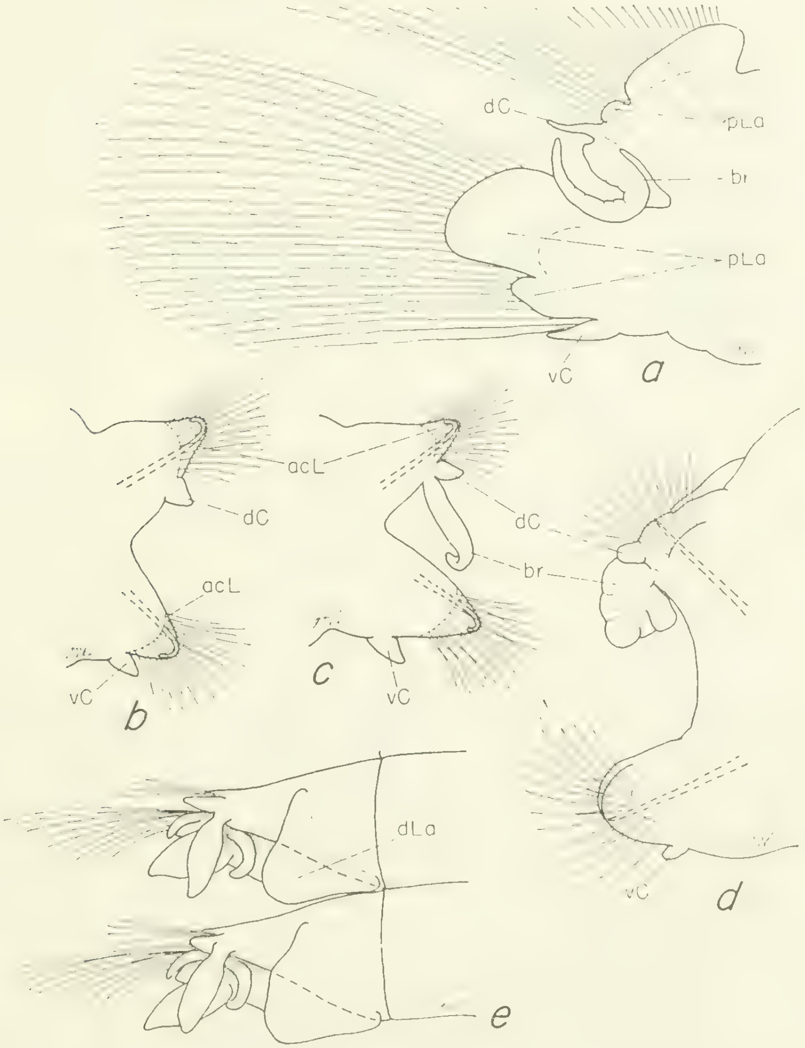

Figure 47.—Nephtyidae, *a*, *Nephtys longosetosa*, parapodium from middle region, posterior view, tips of notosetae not shown. *b–c*, *Micronephthys minuta: b*, parapodium from anterior region; *c*, parapodium from middle region. *d*, *Nephtys paradoxa*, parapodium from middle region, anterior view. *e*, *Nephtys squamosa*, dorsal view two parapodia from middle region.

MATERIAL EXAMINED.—Few specimens from North Atlantic (*Albatross* Station 2084, 40° 16′ N., 67° 05′ W., 1,290 fathoms, 1883; *Albatross* Station 2103, 38° 47′ N., 72° 37′ W., 1,091 fathoms, 1883).

DISTRIBUTION.—Scattered records in the Arctic: Siberian Arctic, Novaya Zemlya, Barents Sea; also north Japan Sea, North Atlantic (off Long Island Sound to off Chesapeake Bay). In 4 to 1,290 fathoms.

Genus *Aglaophamus* Kinberg, 1866; emend. Hartman, 1949

Type (monotypy): *Aglaophamus lyratus* Kinberg, 1866.

Key to the New England Species of *Aglaophamus*

1. Neuropodia with long digitate erect lobe or neuropodial cirrus on upper part (fig. 48*d*). Branchiae begin on setigers 5–8. Prostomium with 2 prominent eyes (fig. 48*c*). Tentacular segment with slender dorsal tentacular cirri (fig. 48*c*) . . . . **A. verrilli**
   Neuropodia without long digitate lobe on upper part. Prostomium without eyes. Tentacular segment without dorsal tentacular cirri 2
2. Branchiae begin on setigers 10–15. Posterior parapodial lamellae short, not longer than the acicular lobes (fig. 48*b*) . . . . **A. malmgreni**
   Branchiae begin on setiger 2. Posterior parapodial lamellae foliaceous, longer than the acicular lobes (fig. 48*a*) . . . . **A. circinata**

Aglaophamus verrilli (McIntosh, 1885)

FIGURE 48,*c*,*d*

Nephthys verrilli McIntosh, 1885, p. 163, figs.—Treadwell, *in* Cowles, 1930, p. 341.—Knox, 1960a, p. 115.

Aglaophamus dicirris Hartman, 1945, pp. 7, 22; 1950, p. 122, pl. 18, figs. 1–8.

DESCRIPTION.—Length up to 44 mm., width up to 3 mm., segments up to 50 or more. Prostomium (fig. 48*c*) long, subrectangular, anterior margin may be thin, spatulate with translucent areas, with subequal antennae, with a pair of conspicuous black eyes on posterior region. Tentacular segment enlarged laterally and ventrally, with ventral tentacular cirri larger than the antennae, with smaller slender dorsal tentacular cirri. Parapodia (fig. 48*d*) with conical acicular lobes. Notopodium with short anterior lamella, large foliaceous posterior lamella. Neuropodium with erect digitiform lobe or cirrus on upper edge, a short bilobed anterior lamella, a broad foliaceous posterior lamella. Ventral cirri conical; dorsal cirri slender, digitiform. Branchiae cirriform, involute, beginning on setigers 5–8 and continuing to near posterior end. Preacicular setae short, barred. Postacicular setae of 2 kinds: (1) long, capillary, smooth and (2) short, furcate, spinous. Proboscis with subterminal papillae in 22 longitudinal rows, 3 to 9 per row.

BIOLOGY.—Found at low water in silty sand and dredged on bottoms of mud.

Material examined.—Chesapeake Bay and off North Carolina (35° N., 75° W.), 14–48 fathoms, *Albatross* Stations; Georgia (Sapelo Island); Florida (Seahorse Key, J. Taylor).

Distribution.—Southern California, Gulf of California to Panama, Chesapeake Bay, Maryland to Georgia, Gulf of Mexico (Florida), New Zealand. Low water to 72 fathoms.

Aglaophamus malmgreni (Théel, 1879)

Figure 48*b*

Nephthys malmgreni Uschakov, 1955, p. 217, fig. 69; 1957, p. 1665.
Aglaophamus malmgreni Pettibone, 1956a, p. 557.
Nephthys (Aglaophamus) malmgreni Berkeley and Berkeley, 1956a, p. 235.

Description.—Length up to 120 mm., width up to 13 mm., segments up to 90. Prostomium suboval, with subequal antennae.

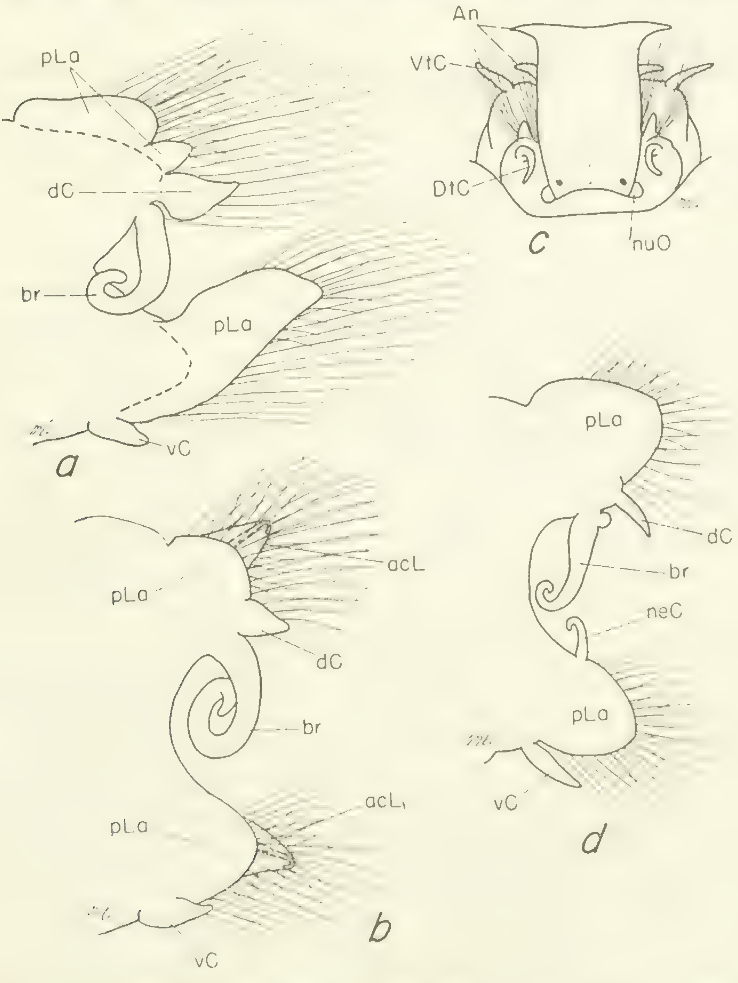

Figure 48.—Nephtyidae, *a*, *Aglaophamus circinata*, parapodium, posterior view. *b*, *Aglaophamus malmgreni*, parapodium, posterior view. *c–d*, *Aglaophamus verrilli*: *c*, dorsal view anterior end; *d*, parapodium, posterior view.

Tentacular segment with ventral tentacular cirri subequal to antennae, without dorsal tentacular cirri. Parapodia (fig. 48*b*) with acicular lobes sharply conical, with anterior lamellae rudimentary. Notopodial posterior lamellae bilobed, as long as or shorter than the acicular lobes. Neuropodial posterior lamellae simple, oval, shorter than the acicular lobes. Dorsal cirri long, digitiform; ventral cirri conical. Branchiae long, cylindrical, involute, beginning on setigers 10–15 and continuing up to last 14–40 segments. Preacicular setae long, barred; postacicular setae very long, denticled. Proboscis with subterminal papillae in 14 longitudinal rows (with some additional papillae anteriorly, distributed irregularly), 10–20 per row.

BIOLOGY.—Dredged on bottoms of mud, sandy mud with red algae.

MATERIAL EXAMINED.—*Albatross* Station 2231, 38°29′ N., 73°09′, W., 965 fathoms, 1883; Gulf of St. Lawrence (south Anticosti Island, 120 fathoms).

DISTRIBUTION.—Widely distributed in the Arctic. Also Bering Sea, north Japan Sea, Gulf of St. Lawrence, off Labrador, off Chesapeake Bay, south to Portugal, Mediterranean. In 3 to 4,001 fathoms.

***Aglaophamus circinata* (Verrill, 1874)**

FIGURE 48*a*

Nephthys circinata Verrill, *in* Smith, Harger, and Verrill, 1874, p. 38.
Nephtys macroura Hartman, 1942c, p. 113, fig. 9*h*; 1944a, p. 339, pl. 15, fig. 11.—Not Schmarda, 1861.

DESCRIPTION.—Length up to 50 mm., width up to 5 mm. Prostomium subpentagonal, anterior margin thin, spatulate with translucent areas near bases of frontal antennae, with antennae subequal or ventral pair larger. Tentacular segment enlarged laterally, with ventral tentacular cirri larger than the antennae, without dorsal tentacular cirri. Parapodia (fig. 48*a*) with conical acicular lobes. Notopodium with rudimentary anterior lamella, a bilobed posterior lamella consisting of a large foliaceous upper part and small short lower part. Neuropodium with short bilobed anterior lamella consisting of a longer upper part and shorter rounded lower part, with a large ligulate posterior lamella directed obliquely upward and outward, being longest in the upper part. Dorsal cirri flat, foliaceous, longer than wide, with pointed tip. Branchiae cirriform, involute, beginning on setiger 2 and continuing to near posterior end. Preacicular setae short, barred; postacicular setae long, smooth.

Proboscis with subterminal papillae in 14 longitudinal rows (plus some additional papillae in anterior part, irregularly arranged), each row consisting of 8 or so larger papillae, followed by 2 to 4 or numerous smaller papillae.

REMARKS.—*A. circinata* has been referred to *A. macroura* Schmarda from the Antarctic and South Atlantic by Hartman, 1942c, 1950; table 5 below shows how they differ.

TABLE 5.—*Differences between* A. macroura *and* A. circinata

Characters	A. circinata	A. macroura
Acicular lobes	Conical	Bilobed in anterior and middle segments
Neuropodial posterior lamellae	Large, ligulate throughout body	Large, triangular to conical in anterior and middle segments; short in posterior segments
Dorsal cirri	Flat, foliaceous, longer than wide	Flat, foliaceous, oval, as wide as long, with mucronate tip (at least in middle segments)
Branchiae	Continue to near posterior end	Small or lacking in posterior segments

BIOLOGY.—Dredged on bottoms of mud, sand, with gravel, rocks, shells. Found in the stomach of haddock (Georges Bank, 1940, 1953, 1955, R. Wigley).

MATERIAL EXAMINED.—Type specimen from off Georges Bank and numerous specimens from Gulf of St. Lawrence, off Nova Scotia, Maine, Massachusetts, Rhode Island, Long Island Sound, in 8 to 430 fathoms.

DISTRIBUTION.—Gulf of St. Lawrence to off Long Island Sound. In 8 to 430 fathoms.

Genus *Nephtys* Cuvier, 1817

Nephthys Savigny, 1820, p. 34.

Type (herein designated): *Nephtys ciliata* (O. F. Müller, 1789).

The species of *Nephtys* represented have the prostomium with the four antennae subequal or the posterior pair may be slightly larger, without conspicous eyes (may be deep-set, inconspicuous); proboscis with 22 longitudinal rows of subterminal papillae, 2 to 8 per row, with a larger middorsal papilla in *N. ciliata*, *N. longosetosa*, *N. picta*, *N. bucera*, and *N. incisa* (fig. 49*b*).

Key to the New England Species of *Nephtys*

1. Tentacular segment with enlarged neuropodial lobe lateral to the setigerous lobe, with a large ventral tentacular cirrus; without dorsal tentacular cirri (figs. 49,*c*,*d*, and 50*a*,*c* 2

Tentacular segment without especially enlarged neuropodial lobe; with dorsal and ventral tentacular cirri subequal (fig. 49*a*) or dorsal pair smaller than ventral pair (may be reduced to a tubercle) 4

2. With overlapping dorsal lamellae above the notopodia, flat over the dorsum (fig. 47*e*) . . . . **N. squamosa** (p. 194)

Without overlapping dorsal lamellae above notopodia 3

3. Ventral tentacular cirri anterolateral, anterior to widest part of enlarged tentacular segment (fig. 50*c*). Dorsal or branchial cirrus without enlarged lobe at base (fig. 50*d*) . . . . **N. picta** (p. 195)

Ventral tentacular cirri lateral and continuous with widest part of enlarged tentacular segment (fig. 50*a*). Dorsal or branchial cirrus with enlarged lobe at base (fig. 50*b*) . . . . **N. bucera** (p. 196)

4. Both anterior and posterior parapodial lamellae about equally well developed, enclosing the conical acicular lobes (fig. 51*a*) . . . . . **N. incisa** (p. 198)

At least anterior parapodial lamellae rudimentary 5

5. Branchiae wide, foliaceous (fig. 47*d*). Posterior parapodial lamellae shorter than the acicular lobes . . . . **N. paradoxa** (p. 200)

Branchiae cirriform, may be inflated basally. Posterior parapodial lamellae as long as or longer than the acicular lobes 6

6. Posterior parapodial lamellae rather short, about same length or only slightly surpassing the acicular lobes (fig. 51*c*) . . . . **N. ciliata** (p. 202)

Posterior parapodial lamellae longer 7

7. Branchiae inflated basally (fig. 51*e*), rudimentary or absent on posterior half of body. Both notopodial and neuropodial posterior lamellae, short, inconspicuous in posterior region of body (fig. 51*f*). . **N. discors** (p. 203)

Branchiae cirriform, continuing to near posterior end. Posterior lamellae better developed in posterior region 8

8. Both notopodial and neuropodial posterior lamellae large, foliaceous throughout length of body (fig. 51*b*) . . . . **N. caeca** (p. 203)

Notopodial posterior lamellae of middle and posterior region of same length or extend only slightly beyond acicular lobes, neuropodial posterior lamellae extend well beyond the acicular lobes, bilobed or irregularly sinuous (fig. 47*a*) . . . . **N. longosetosa** (p. 204)

***Nephtys squamosa* Ehlers, 1887**

FIGURE 47*e*

Nephthys squamosa Fauvel, 1936b, p. 41.
Nephtys squamosa Hartman, 1950, p. 110.

DESCRIPTION.—Length up to 50 mm., width up to 3 mm., segments up to 120. Prostomium with anterior margin thin, spatulate, with translucent areas; lateral borders may be so inflated as to conceal the neurosetal bundles. With dorsal lamellae on dorsolateral surfaces of body beginning on about setiger 17 (slight indication of them more anteriorly). The lamellae become larger more posteriorly and may overlap the following segments (fig. 47*e*). Similar ventral lamellae develop on the ventrolateral surfaces of the body, although not as large. Parapodia with conical acicular lobes; anterior lamellae rudimentary. Notopodial posterior lamellae elongate, ligulate, foliaceous. Neuropodial posterior lamellae elongated, diagonally curved upward. Branchiae cirriform, sickle shaped, begin on setigers 2–4, continuing to near posterior end.

Biology.—Dredged on bottoms of sand, fine sand and mud, with coral and shells.

Material examined.—Off Martha's Vineyard, Massachusetts (*Fish Hawk* Station 865-7, 40°05′ N., 70°22′ W., 64–65 fathoms, 1880; *Albatross* III, 40°31′N., 67°37′W., 66 fathoms, 1955; 40°09′N., 68°58′W., 74 fathoms; 40°20′N., 69°05′W., 58 fathoms, 1957, R. Wigley; *Fish Hawk* Station 1036, 39°58′N., 69°30′W., 94 fathoms, 1881).

Distribution.—Both sides tropical America, Puerto Rico, off Florida, Massachusetts, Morocco. In 14 to 120 fathoms.

Nephtys picta Ehlers, 1868

Figures 49*c*, 50,*c–f*

Nephthys picta Ehlers, 1868, p. 632, pl. 23, figs. 9, 35 (part ?).—Verrill and Smith, 1874, pp. 54, 289, pl. 12, fig. 57.—Webster, 1879, p. 214; 1886, p. 131.—Verrill, 1881, pp. 296, 300, 317.—Andrews, 1891a, p. 281.

Nephtys picta Hartman, 1944a, p. 339, pl. 15, figs. 3–4 (as *N. bucera;* not fig. 8, =*N. ciliata?*); 1945, p. 22; 1950, p. 103; 1951, p. 49, pl. 10, fig. 4.

Description.—Length up to 60 mm. (up to 300 mm., according to Ehlers), width up to 4 mm., segments up to 100 (138, according to Ehlers). Prostomium (figs. 49*c*, 50*c*) squarish, with rounded corners, arched dorsally (not as flat as *N. bucera*) with 4 antennae subequal, visible dorsally, the posterior pair only partly hidden by the tentacular segment. Tentacular segment with conical notopodial and neuropodial setigerous lobes, with setae directed anteriorly, lateral to prostomium, with enlarged rounded lateral neuropodial lobe with the ventral tentacular cirrus anterolateral near the neurosetae; without dorsal tentacular cirri.

Parapodia with acicular lobes bilobed (anterior and middle regions) to low conical (posterior region), with notopodial anterior lamellae low, shorter than the acicular lobes. Neuropodial anterior lamellae with upper part longer than the acicular lobe (anterior region) or slightly shorter than the acicular lobes (middle and posterior regions). Posterior lamellae elongate oval, much longer than the acicular lobes. Preacicular setae shorter, barred, tapering to fine tips. Postacicular setae longer, slender, of 2 kinds: (1) Smooth, capillary; (2) finely spinous with coarser spines near basal curved part (fig. 50*e*,*f*). Setae rather short (not as long and flowing as in *N. bucera*), appearing darker basally (similar to *N. incisa*).

Branchiae (fig. 50*d*) cirriform, sickle shaped, beginning on setigers 3–4 and continuing to near posterior end. Dorsal or branchial cirrus subulate, widest basally, tapering distally (without enlarged lobe at base as in *N. bucera*). Ventral cirri conical. Color: without color; faintly to darkly pigmented, variously marked, may be somewhat banded on anterior region, the bands may be more or less continuous as a dark brown median dorsal longitudinal line; prostomium without color or with scattered pigment spots (fig. 49*c*).

Biology.—Found at low water in muddy sand, sandy rubble, gravelly sand. Dredged on bottoms of sand, muddy sand, with shells, sea weeds.

Material examined.—Type specimens from Nahant, Massachusetts (deposited in MCZ, Harvard, poor condition, dried up). Also numerous specimens from Massachusetts (Woods Hole region, Stony Beach, Nobska, North Falmouth, Chappaquoit; Nantucket Sound, off Martha's Vineyard; Elizabeth Islands, Hadley Harbor, Nonamesset Island, Cuttyhunk; Cape Cod, Wellfleet; North and South ponds, Megansett Estuary), Rhode Island (Greenwich Bay, off Newport), New Jersey (Great Egg Harbor), Maryland (off Chesapeake Bay), North Carolina (Beaufort), low water to 21 fathoms.

Distribution.—Massachusetts (Cape Cod) to South Carolina. Low water to 21 fathoms.

Nephtys bucera Ehlers, 1868

Figures 49*d*; 50,*a*,*b*; 51*d*

Nephthys bucera Ehlers, 1868, p. 617, pl. 23, fig. 8.—Verrill and Smith, 1874, pp. 122, 289, pl. 12, fig. 58.—Verrill, 1881, pp. 296, 300.—Webster and Benedict, 1884, p. 702.—Andrews, 1891a, p. 280.—Sumner, Osburn, and Cole, 1913, p. 619 (part).—Coonfield, 1931, p. 416; 1934, p. 399.

Nephthys picta McIntosh, 1900, p. 266, pl. 7, figs. 3–5, 8, pl. 8, figs. 9–11.—Whiteaves, 1901, p. 83.—Treadwell, 1948, p. 23, fig. 10,*b*,*c*.—Not Ehlers, 1868.

Nephtys bucera Hartman, 1944a, p. 339, not pl. 15, figs. 3,4 (=*N. picta*); 1950, p. 105; 1951, p. 49.

Description.—Length up to 300 mm., width up to 20 mm., segments up to 140. Prostomium (figs. 49*d*; 50*a*) with anterior margin thin, flat, spatulate, tapering laterally into the anterior pair of antennae, with translucent areas at their inner bases. Posterior pair of antennae emerge from depressions ventrolaterally, hidden from view dorsally by the enlarged tentacular segment. Tentacular segment with conical notopodial and neuropodial setigerous lobes with setae directed anteriorly, lateral to prostomium; with enlarged flattened membranous lateral neuropodial lobes each with ventral tentacular cirrus extending laterally about midway along lobe; without dorsal tentacular cirri or represented by a rudimentary knob lateral to the notopodium.

Parapodia (fig. 51*d*) with acicular lobes distinctly bilobed (anterior region) to rounded or slightly incised. Rounded anterior lamellae slightly shorter than the acicular lobes. Posterior lamellae much longer than the acicular lobes, elongate oval, the borders of which may be undulate or somewhat frayed. Preacicular setae shorter, barred, tapering to fine tips. Postacicular setae longer, slender, of 2 kinds: (1) Smooth, capillary; (2) curved, finely spinous, more coarsely serrated along basal portion where there may be 5–7 rather large hooks. Setae long, flowing, light colored.

Branchiae cirriform, sickle-shaped, beginning on setigers 4–8, continuing to near posterior end. Dorsal or branchial cirrus with en-

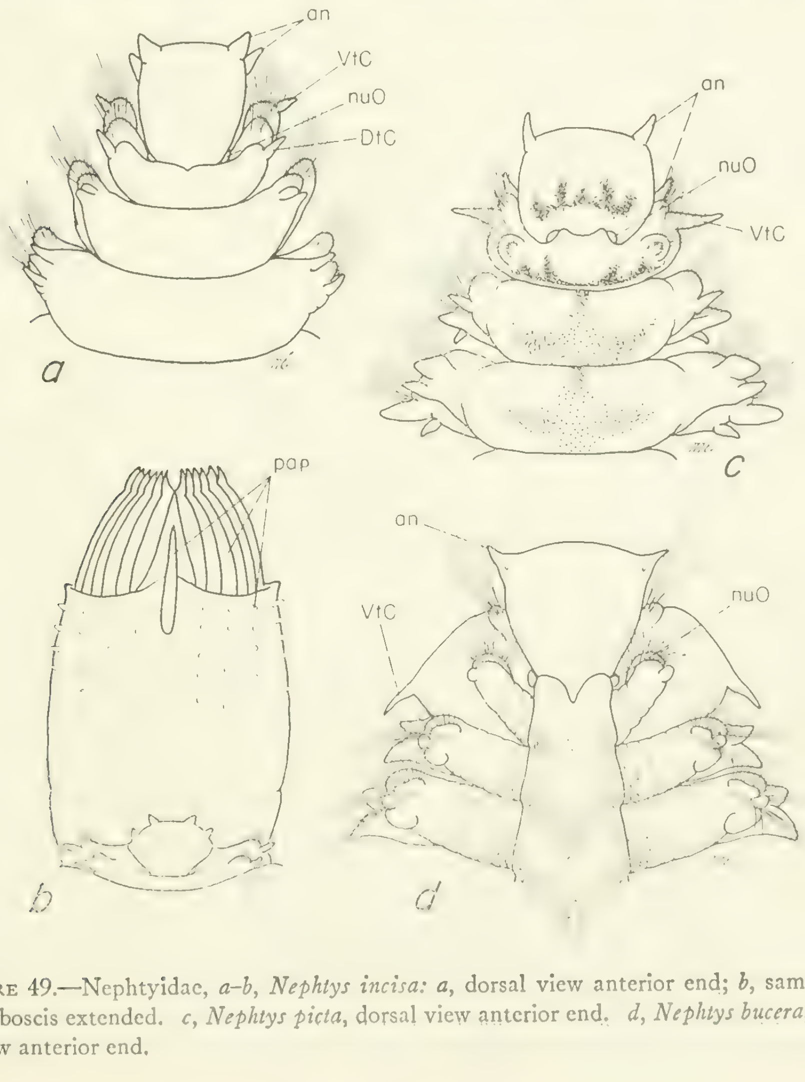

FIGURE 49.—Nephtyidae, *a–b*, *Nephtys incisa: a*, dorsal view anterior end; *b*, same, with proboscis extended. *c*, *Nephtys picta*, dorsal view anterior end. *d*, *Nephtys bucera*, dorsal view anterior end.

larged lobe on upper basal part (fig. 50*b*). Ventral cirri conical to large, flattened, triangular. Color: without color; dusky with darker pigmented bands; white with dark V-shaped pigmented bands (fig. 49*d*); prostomium colorless or with dark spot in center.

Biology.—Found at low water in sand bars, in shifting sand, in muddy sand. Dredged on bottoms of sand and stones.

Material examined.—Type specimen from Isle of Shoals, New Hampshire? (in MCZ, Harvard). Also numerous specimens from Gulf of St. Lawrence (St. Lawrence estuary), Nova Scotia (Cambridge and Lawrencetown), Maine (Griffith Head, Georgetown Island, Sheepscot Bay; Old Orchard Beach; York; Sea Point near Kittery), New Hampshire (Rye Harbor, Hampton Harbor), Massachusetts (Georges Bank, 18–98 fathoms; Cape Ann, Annisquam River, Gloucester; Cape Cod, Provincetown, Truro; Lagoon Pond on Martha's Vineyard; Nantucket Sound, Woods Hole region, Nobska and Stony Beach), Rhode Island (off Newport), New Jersey (Great Egg Harbor), Virginia (Willoughbys Sand Spit), North Carolina (Beaufort), Mississippi (Gulf Coast), Florida (Seahorse Key).

Distribution.—Gulf of St. Lawrence to North Carolina, Gulf of Mexico (Mississippi). Low water to 98 fathoms.

Nephtys incisa Malmgren, 1865

Figures 49,*a*,*b*; 51*a*

Nephthys ingens Verrill and Smith, 1874, pp. 137, 140, 213, 227, 289, pl. 12, figs. 59–60.—Treadwell, *in* Cowles, 1930, p. 341.—Not Stimpson, 1854.

Nephthys incisa Verrill, 1881, pp. 297, 300, 304, 307, 311, 313, 315, 317, 321.—Webster and Benedict, 1884, p. 702; 1887, p. 709.—Webster, 1886, p. 131.—Whiteaves, 1901, p. 83.—Moore, 1909a, p. 137.—Sumner, Osburn, and Cole, 1913, p. 619.—Fauvel, 1923, p. 369, fig. 144,*a*, *b*.—Støp-Bowitz, 1948a, p. 63.—Wesenberg-Lund, 1950a, p. 21; 1950b, p. 60; 1951, p. 45.—Clark, 1960, p. 21.

Nephthys lawrencii McIntosh, 1900, p. 265, pl. 7, fig. 2, pl. 8, figs. 7, 8.—Whiteaves, 1901, p. 83.

Nephthys phyllocirra Treadwell, *in* Cowles, 1930, p. 341.—Not Ehlers, 1887.

Nephtys incisa Hartman, 1944a, p. 339, pl. 15, fig. 5 (as *N. buccra*); 1950, p. 108.—Clark, 1955, p. 547; 1957, p. 261.—Stickney. 1959, p. 15.—Eliason, 1962, p. 249.

Description.—Length up to 150 mm., width up to 15 mm., segments up to 75. Tentacular segment (fig. 49*a*) with setae well developed, extending anteriorly, with both dorsal and ventral tentacular cirri subequal to the antennae. Parapodia (fig. 51*a*) with rami well separated, with acutely conical acicular lobes. All the lamellae similar, rounded, small, shorter than or not much longer than the acicular lobes. Thus the acicular lobes are rather well hidden by the lamellae (the anterior lamellae may be somewhat undulate or slightly bilobed). Setae relatively short, appearing yellow to bronzy to blackish. Preacicular setae short, dark brown, barred; postacicular setae relatively short, deep yellow, minutely serrated. Tips of acicula may be covered with chitinous plates. Ventral cirri short, flattened, triangular to conical. Branchiae begin on setigers 6–8, small anteriorly, becoming larger, then in the posterior half becoming smaller where they may be equal in size to the dorsal cirri, absent from the last 12 or so segments; where best developed, they are large, recurved, sickle-shaped. Dorsal cirri small anteriorly, becoming large, flattened, triangular, then smaller, digitiform in the posterior region.

Proboscis (fig. 49*b*) with 10 pairs bifid terminal papillae and 20–22 longitudinal rows of subterminal papillae, 1–6 per row. Papillae very small. Large middorsal and smaller midventral papilla present.

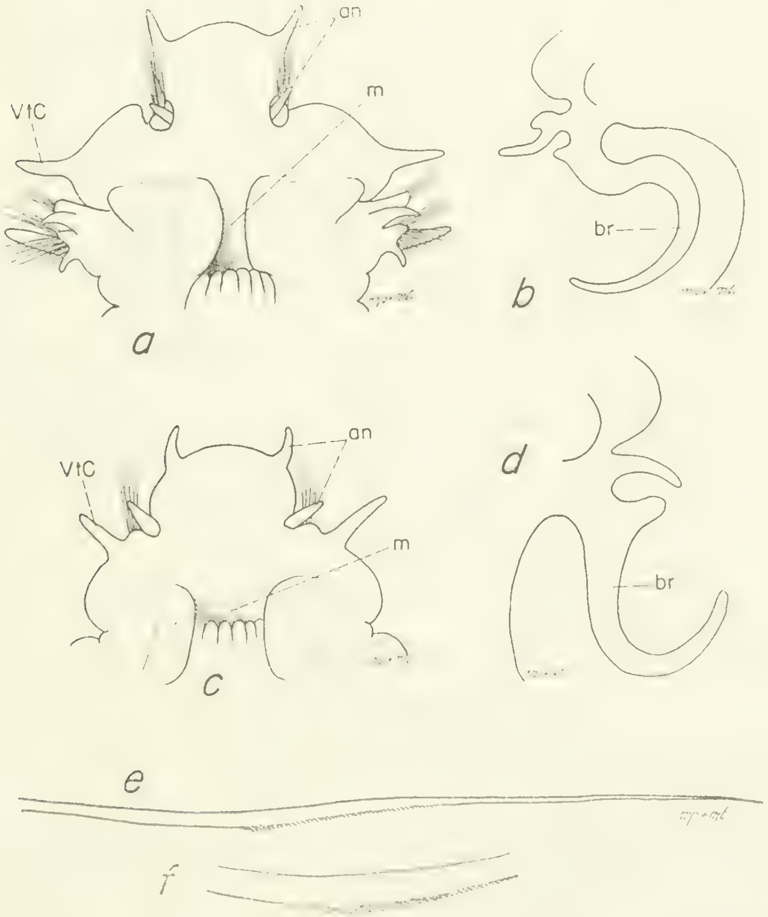

FIGURE 50.—Nephtyidae, *a–b*, *Nephtys bucera: a*, ventral view anterior end; *b*, branchia and branchial or dorsal cirrus from middle parapodium. *c–f*, *Nephtys picta: c*, ventral view anterior end; *d*, branchia and branchial or dorsal cirrus from middle parapodium; *e*, spinous postacicular notoseta from middle parapodium; *f*, part of same, enlarged.

Color: white or brownish, with red middorsal blood vessel, red branchiae and midventral red streak, setae dark.

Biology.—Found rarely at low water in mud. Dredged on bottoms of soft or sticky mud, muddy sand, very fine or coarse sand, mud with gravel, shells, worm or amphipod tubes, and "weed" (Lagoon Pond, Martha's Vineyard). They burrow in mud of all kinds, even in that so filled with decaying debris as to be very fetid. They are the most common and abundant species on muddy bottoms along the New England coast, in bays and sounds as well as off the open coast. They were found in the stomach of peaked-nose skate (Verrill) and haddock (Georges Bank, 1953, R. Wigley). Nothing is known concerning its embryology. Specimens with coral pink eggs were found in August in Massachusetts (Buzzards Bay, August 11, 1953). Young specimens of 28–32 segments were found in August in Maine (Ebenecook Harbor, Southport Island, August 2, 1955; Muscongus Bay, August 29, 1955); they had prominent pointed conical acicular lobes without much sign of lamellae.

Material examined.—Numerous specimens from Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, 3 to 12 fathoms), Nova Scotia (*Albatross* III, 42° 10′ N., 69° 58′ W., 80 fathoms, 1955, R. L. Wigley), New Brunswick (west Quoddy Bay), Prince Edward Island (Richmond Bay), Maine (Muscongus Bay near Hog Island; Boothbay Harbor region, Morgan's Bay, north end Long Ledge, Sheepscot River; Middle Cove and Love's Cove in Ebenecook Harbor, Southport Island; cove, southeast Barter Island; Cross River off Sheepscot), New Hampshire (Portsmouth Harbor), Massachusetts (Gloucester Harbor, Massachusetts Bay, Cape Cod Bay, Vineyard Sound, Nantucket Sound, Buzzards Bay, low water to 28 fathoms).

Distribution.—Greenland, Davis Strait, Iceland, Norway, Sweden, North Sea, Baltic to Portugal, Mediterranean, Gulf of St. Lawrence to Virginia, Chesapeake Bay. Low water to 954 fathoms.

***Nephtys paradoxa* Malm, 1874**

Figure 47*d*

Nephthys canadensis McIntosh, 1900, p. 264, pl. 7, fig. 1, pl. 8, figs. 4–6.—Whiteaves, 1901, p. 83.

Nephthys paradoxa Fauvel, 1923, p. 375, fig. 146,*f–i*.—Wesenberg-Lund, 1953, p. 44.—Uschakov, 1955, p. 217, fig. 69.

Nephtys paradoxa Hartman, 1944a, p. 339, pl. 15, fig. 6.—Pettibone, 1954, p. 271, fig. 30,*j–k*.—Eliason, 1962, p. 249.

Description.—Length up to 200 mm., width up to 13 mm., segments up to 150. Tentacular segment with ventral tentacular cirri larger than the antennae, dorsal tentacular cirri reduced to a tubercle. Parapodia (fig. 47*d*) with notopodial acicular lobes rounded,

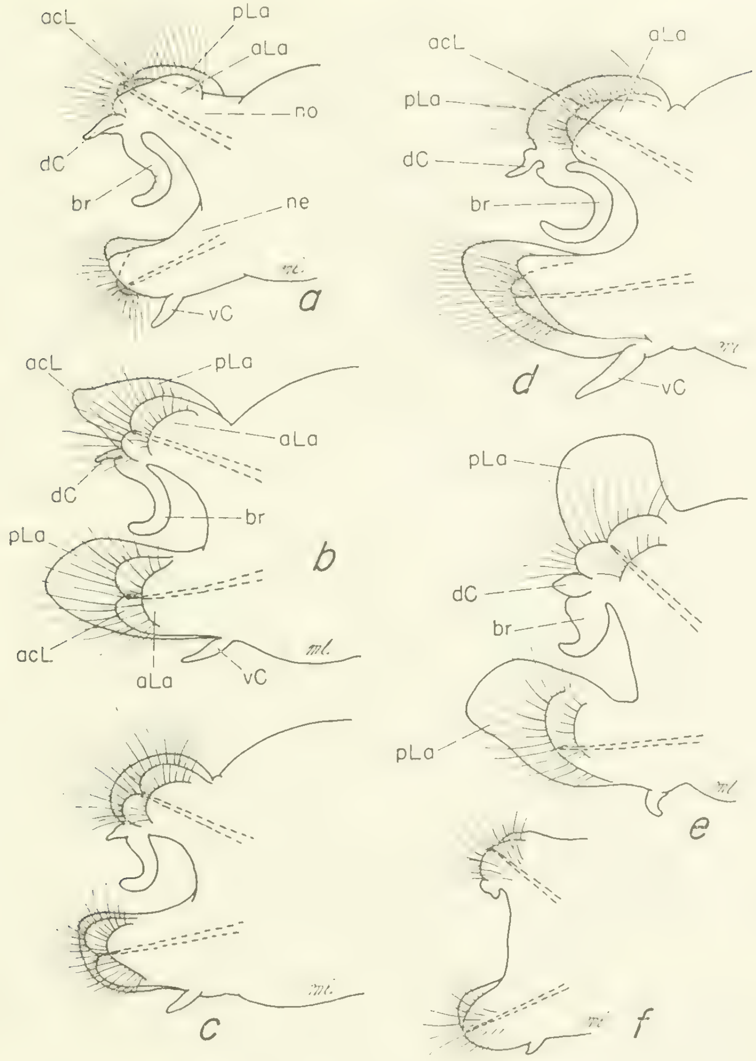
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FIGURE 51.—Nephtyidae, *a*, *Nephtys incisa*, middle parapodium, anterior view. *b*, *Nephtys caeca*, parapodium from anterior region, anterior view. *c*, *Nephtys ciliata*, parapodium from anterior region, anterior view. *d*, *Nephtys bucera*, middle parapodium, anterior view. *e–f*, *Nephtys discors: e*, middle parapodium, anterior view; *f*, posterior parapodium, anterior view.

neuropodial acicular lobes conical. Anterior lamellae rudimentary; posterior lamellae simple, rounded, shorter than acicular lobes. Tips of acicula covered by yellow chitinous plates. Preacicular setae short, barred; postacicular setae longer, finely spinous. Ventral cirri short, triangular; dorsal cirri flattened, triangular, pointed. Branchiae begin on setigers 8–14, short, triangular at first, then become wide, foliaceous, absent on last 15–40 segments.

BIOLOGY.—Dredged on bottoms of mud, sandy mud, mud with fine gravel, rocks, worm tubes.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, St. Lawrence estuary, 16–43 fathoms), Maine (Location 170–1, 173, 186, Gulf of Maine, off Eastern Point Light, 90–110 fathoms, 1878, U.S. Fish Commission), Massachusetts (off Georges Bank, 110–150 fathoms, 1872; Location 124, off Salem, 51 fathoms, 1877; Location 363, off Cape Cod, 108 fathoms, 1879; Location 1029, off Martha's Vineyard, 458 fathoms, 1881).

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Faroes to France, Gulf of St. Lawrence to off Delaware, north Japan Sea to Japan. In 3.3 to 4,001 fathoms.

Nephtys ciliata (O. F. Müller, 1789)

FIGURE 51*c*

Nephthys ciliata Webster and Benedict, 1887, p. 709.—Whiteaves, 1901, p. 82.—Fauvel, 1923, p. 371, fig. 145,*a–b*.—Grainger, 1954, p. 515.—Uschakov, 1955, p. 217, fig. 68.—Berkeley and Berkeley, 1956a, p. 235.—Clark, 1960, p. 21.

Nephtys ciliata Hartman, 1944a, p. 339, pl. 15, fig. 9.—Pettibone, 1954, p. 270, fig. 30*n;* 1956a, p. 558.—Eliason, 1962, p. 249.

DESCRIPTION.—Length up to 300 mm., width up to 13 mm., segments up to 140. Tentacular segment with dorsal and ventral tentacular cirri subequal to antennae. Parapodia (fig. 51*c*) with acicular lobes bilobed in anterior and middle regions, rounded or slightly bilobed in posterior region. Anterior lamellae rudimentary; posterior lamellae rounded, short, about same length or only slightly surpassing the acicular lobes. Tips of acicula covered with dark chitinous plates. Preacicular setae short, fine, barred; postacicular setae long, flowing. Ventral cirri conical; dorsal cirri digitiform. Branchiae cirriform, sickle shaped, begin on setigers 4–8, rudimentary on last 20–30 segments.

BIOLOGY.—Found at low water in mud, muddy sand, gravelly mud, or sand. Dredged on bottoms of mud, sand, and combinations of mud, muddy sand, pebbles, gravel, stones, rocks, shells. Found in stomach of the Atlantic cod *Gadus callarias* (Grainger, 1954) and haddock (Georges Bank, 1953, R. Wigley).

MATERIAL EXAMINED.—Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, St. Lawrence estuary, low water to 60 fathoms), New Brunswick (St. Andrews), Maine (Red Beach, St. Croix River; Starboard Creek, Machias Bay; Boothbay Harbor region, Ebenecook Harbor, Southport Island, 2 fathoms; Hendricks Head Beach, Southport Island; Riggs Cove, Robinhood, Georgetown Island; Isle of Springs; Barter Island; off Merrill Ledge, Sheepscot River; North Edgecomb; Cross River off Sheepscot), New Hampshire (Newcastle, Wentworth), Massachusetts (Georges Bank, 37–136 fathoms; Massachusetts Bay off Plymouth, 17 fathoms).

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Faroes to France, Hudson Bay, Labrador to Massachusetts, Alaska to southern California, north Japan Sea to Japan, China. Low water to 500 fathoms.

Nephtys discors Ehlers, 1868

FIGURE 51,*e,f*

Nephthys discors Verrill, 1873b, p. 103.—Webster and Benedict, 1887, p. 709.
Nephtys discors Pettibone, 1954, p. 270.

DESCRIPTION.—Length up to 300 mm., width up to 12 mm., segments up to 120. Tentacular segment with dorsal pair tentacular cirri subequal to or about half as long as ventral pair. Parapodia with notopodial acicular lobes bilobed in anterior and middle regions, rounded in posterior region. Neuropodial acicular lobes slightly bilobed to rounded. Anterior lamellae rudimentary; posterior lamellae in anterior and middle regions (fig. 51*e*) large, foliaceous, extending well beyond the acicular lobes. In the posterior region (fig. 51*f*) posterior lamellae short, inconspicuous. Tips of acicula covered with yellow chitinous plates. Preacicular setae short, barred; postacicular setae longer, finely spinous. Ventral cirri short, conical; dorsal cirri flattened, triangular, pointed. Branchiae begin on setiger 6, small at first, become larger, inflated basally, hooked distally, rudimentary on posterior half of body.

BIOLOGY.—Found at low water on bottoms of muddy sand, gravelly sand, among mussels. Dredged on bottoms of mud, gravelly mud, stones, rocks, worm tubes.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Bay of Chaleurs, 6 fathoms), New Brunswick (St. Andrews), Maine (Starboard Creek, Machias Bay; Rock ledge opposite C-1 Buoy, Sheepscot River, Boothbay Harbor region), Japan (off Kamchatka, 54° N., 155° E., 53 fathoms, M. Imajima, collector).

DISTRIBUTION.—Alaskan Arctic to southern California, Japan, Gulf of St. Lawrence to Maine. Low water to 268 fathoms.

Nephtys caeca (Fabricius, 1780)

FIGURE 51*b*

Nephthys caeca Verrill, 1881, pp. 294, 295, 296, 307, 314.—Webster and Benedict, 1887, p. 709.—Whiteaves, 1901, p. 82.—Not Moore, 1909a, p. 137(=*N. ciliata*).—Kindle, 1917, p. 150.—Fauvel, 1923, p. 365, fig. 142,*a–l;* 1933, p. 39.—Préfontaine, 1932, p. 207.—Procter, 1933, p. 136.—Annenkova, 1937, p. 164; 1938, p. 163.—Berkeley and Berkeley, 1948, p. 54, figs. 80–81.—Uschakov, 1955, p. 217, fig. 68.—Clark, 1960, p. 20.

Nephtys caeca Hartman, 1944a, p. 333, pl. 15, fig. 10 (as *N. ciliata*); 1948, p. 24; 1950, p. 95.—Hartman and Reish, 1950, p. 18.—Clark, 1955, p. 547; 1957, p. 269.—Stickney, 1959, pp. 14, 15.

Nephthys coeca Gorbunov, 1946, p. 38.—Thorson, 1946, p. 71, fig. 34.—Wesenberg-Lund, 1950a, p. 20; 1950b, p. 57; 1951, p. 43.

Description.—Length up to 250 mm., width up to 15 mm., segments up to 150. Tentacular segment with dorsal and ventral pairs tentacular cirri subequal. Parapodia (fig. 51*b*) with acicular lobes bilobed to rounded. Anterior lamellae rudimentary; posterior lamellae long, oval, foliaceous throughout the length of the body, the neuropodial lamellae extending further than the notopodial. Tips of acicula covered with yellow chitinous plates. Preacicular setae short, barred; postacicular setae long, yellow, finely spinous. Ventral cirri short, conical; dorsal cirri digitiform. Branchia cirriform, sickle shaped, begin on setigers 4–6, continuing to near posterior end. Color: white, dusky, greenish or greenish bronzy.

Biology.—Found at low water in shifting sand, muddy sand, gravelly sand, mud with rocks and gravel. Dredged on bottoms of clean sand, soft mud, muddy sand, mud and broken shells and gravel. Found in the stomach of haddock (Georges Bank, 1953, R. Wigley).

Material examined.—Numerous specimens from Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, St. Lawrence estuary, Madeleine Islands, low water to 26 fathoms), Nova Scotia (Cape Breton Island), New Brunswick (St. Andrews), Maine (Red Beach and Robbinston, St. Croix River; Starboard Creek, Machias Bay; Glen Cove, mouth Penobscot Bay; Samoset Point, Rockland; Boothbay Harbor region; Waites Landing, Falmouth Foreside; Sea Point near Kittery), New Hampshire (Hilton Park, Dover Point; Little Harbor, Sheafes Point; Newcastle and Wentworth; Rye Harbor, Hampton Harbor), Massachusetts (Georges Bank, 39–66 fathoms; Essex; Duxbury, Marblehead; Cape Cod, Orleans and Barnstable; Nantucket Sound; Cuttyhunk; Hadley Harbor, Nonamesset Island), Washington (Puget Sound and Washington Sound, low water to 50 fathoms).

Distribution.—Scattered records in the Arctic (Siberian and Alaskan Arctic, Greenland, Spitsbergen). Also Iceland, Faroes, Norway to North Sea, Baltic, English Channel, Gulf of St. Lawrence to off Rhode Island; Alaska to northern California; north Japan Sea to Japan. Low water to 306 fathoms.

***Nephtys longosetosa* Oersted, 1843**

Figure 47*a*

Nephthys longisetosa Verrill, 1881, pp. 295, 319.—Not Malmgren, 1865.

Nephthys longosetosa Fauvel, 1923, p. 367, fig. 143, *f–h*.—Uschakov, 1955, p. 219, fig. 68.—Southward, 1956, p. 264.—Clark, 1960, p. 20.

Nephtys longosetosa Hartman, 1944a, p. 339, pl. 15, fig. 7.—Pettibone, 1954, p. 268, fig. 30*l*; 1956a, p. 558.

Description.—Length up to 170 mm., width up to 6 mm., segments up to 120. Tentacular segment with dorsal and ventral tentacular cirri subequal. Parapodia with acicular lobes slightly bilobed to rounded. Anterior lamellae rudimentary. Notopodial posterior lamellae in anterior region rather large, rounded, bilobed; in middle (fig. 47*a*) and posterior regions the notopodial posterior lamellae extend slightly beyond or about same length as acicular lobes. Neuropodial posterior lamellae larger than acicular lobes in anterior region; they extend well beyond the acicular lobes in the middle and posterior regions, bilobed or irregularly sinuous. Preacicular setae short, barred; postacicular setae long, flowing, finely spinous. Ventral cirri conical; dorsal cirri long, digitiform. Branchiae cirriform, sickle shaped, begin on setigers 3–4, continuing to near posterior end.

Biology.—Dredged on bottoms of sand, sandy mud, gravel, stones and mud. May be found in clean sand on moderately exposed beaches (Southward).

Material examined.—Massachusetts (south Martha's Vineyard Lightship, 16 fathoms).

Distribution.—Widely distributed in the Arctic. Also Iceland, Faroes, Norway to France, Hudson Bay, Labrador to Massachusetts, Alaska to Lower California and Panama, north Japan Sea, Straits of Magellan. Low water to 528 fathoms.

Family Sphaerodoridae

Body short, oval or elongate, cylindrical. Prostomium and tentacular segment indistinct, covered with papillae, some of which are larger, resembling antennae and tentacular cirri. Eyes usually 2 or 4, under integument. Anterior end may be invaginated. Integument covered with small glandular papillae and two or more rows of segmentally arranged large spherical glandular capsules. The capsules just dorsal to the parapodia are sometimes referred to as dorsal cirri; they differ from the usual type of dorsal cirri, however, in that they are immovable, unjointed and glandular, rather than sensory. Segmentation indistinct except as marked by the parapodia. Parapodia uniramous, covered with papillae, some of which may be longer. Setae simple or compound. Pygidium bears a median papilla and a pair of globular capsules. Eggs are large, granular cells with tough, smooth or papillose shells. Proboscis eversible, unarmed, smooth globular or cylindrical.

Key to the New England Genera of Sphaerodoridae

1.	Setae simple, hooked (fig. 52*c*)	**Sphaerodorum**
	Setae compound (fig. 52*f*)	**Ephesiella**

Genus *Sphaerodorum* Oersted, 1843; char. emend.

Ephesia Rathke, 1843, preoccupied by Heubner (1818, Lepidoptera); type (monotypy): *Ephesia gracilis* Rathke, 1843.

Pollicita Johnston, 1845; type (monotypy): *Pollicita peripatus* Johnston, 1845; =*Sphaerodorum gracilis* (Rathke, 1843).

Type (monotypy): *Sphaerodorum flavum* Oersted, 1843;=*Sphaerodorum gracilis* (Rathke, 1843).

The genus is herein revised in compliance with the rules of nomenclature. *Ephesia* Rathke, 1843, with type *E. gracilis*, although preoccupied by Heubner in Lepidoptera, has continued to be used. *Sphaerodorum* Oersted, 1843, with type *S. flavum* and a synonym of *E. gracilis*, has been used in a different sense following Levinsen, 1883.

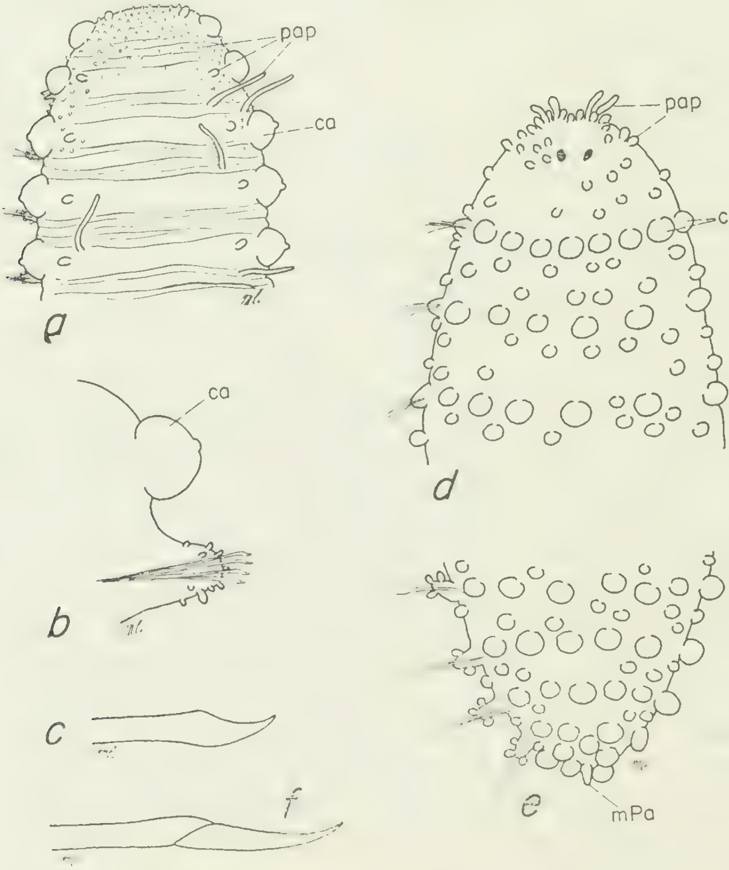

FIGURE 52.—Sphaerodoridae, *a–c*, *Sphaerodorum gracilis: a*, dorsal view anterior end; *b*, parapodium; *c*, seta. *d–f*, *Ephesiella minuta: d*, dorsal view anterior end; *e*, same, posterior end; *f*, seta.

As used herein, *Sphaerodorum* includes *Ephesia gracilis* Rathke (=*Sphaerodorum flavum* Oersted, *Pollicita peripatus* Johnston, *Sphaerodorum papillifer* Moore). Setae simple. Dorsal glandular capsules two (as in type) or more per segment.

Contains only one New England species.

Sphaerodorum gracilis (Rathke, 1843)

FIGURE 52,*a–c*

Ephesia gracilis Webster and Benedict, 1887, p. 728.—Southern, 1914, p. 88.—Fauvel, 1923, p. 377, fig. 148,*a–f*.—Uschakov, 1955, p. 220, fig. 70.—Pettibone, 1956a, p. 559.—Clark, 1960, p. 21.—Day, 1960, p. 326.
Sphaerodorum gracile Eliason, 1962, p. 247.

DESCRIPTION.—Length up to 60 mm., width up to 1 mm., segments up to 120. Body elongate, slender, flattened ventrally, strongly arched dorsally, widest near anterior end, tapering slightly anteriorly and more so posteriorly. Eyes four, under integument (may be some additional spots). Integument covered with minute papillae dorsally and ventrally. Spherical glandular capsules present in two dorsolateral longitudinal rows above parapodia (fig. 52,*a*,*b*); capsules with short papilliform process. Parapodia short, conical, covered with cylindroconical papillae, one near the distal tip being larger and forming a postsetal lip (sometimes referred to as ventral cirrus). Setae few in number (4–6), simple, short, with tip curved (fig. 52*c*). Aciculum colorless.

Color: pale yellow to brownish yellow with capsules opaque yellowish white, eyes deep brown. Females may be filled with large oval eggs with thick shell; shell is striated, irregularly thickened, appearing as polygonal areas (specimens from Greenland). Eggs dark red with purplish tinge (Webster and Benedict).

BIOLOGY.—Found at low water in coralline algal region, in fissures of rocks. Dredged on bottoms of fine sand, mud, sandy mud, rocks, with shells, hydroids, sponges. It is able to crawl slowly and may twist in screwlike coils (McIntosh). Taken in surface tow at night in Ireland (Southern). Found in the stomach of haddock (Georges Bank, 1954, R. Wigley).

MATERIAL EXAMINED.—Gulf of St. Lawrence (Bay of Chaleurs, south of Anticosti Island, 15–80 fathoms), off Nova Scotia (US Fish Commission Location 164, 42°36′ N., 70°27′ W., 75 fathoms, 1878), Massachusetts (Georges Bank, 62–182 fathoms; Location 32–33, off Salem, 90 fathoms, 1877; Location 1038, off Martha's Vineyard, 39°58′ N., 70°06′ W., 146 fathoms, 1881).

DISTRIBUTION.—Widely distributed in the Arctic; also Iceland, Norwegian Coast to North Sea, France, Mediterranean, Labrador to Massachusetts, Bering Sea to southern California, north Japan Sea, Antarctic, South Africa. Low water to 723 fathoms; surface waters.

Genus *Ephesiella* Chamberlin, 1919; char. emend.

Type (original designation): *Sphaerodorum peripatus* Claparède, 1863; =*Ephesiella abyssorum* (Hansen, 1882). Not *S. peripatus* (Johnston, 1845).

The junior synonym of *Sphaerodorum peripatus* Claparède, 1863, must be used as it is preoccupied by *Sphaerodorum peripatus* (Johnston, 1845). Setae compound (as in type). Segmental spherical glandular capsules 2 (as in type) or more per row. Body elongated, cylindrical (as in type) to short, oval.

Contains only one New England species.

Ephesiella minuta (Webster and Benedict, 1887)

FIGURE 52,*d–f*

Ephesia minuta Webster and Benedict, 1887, p. 728, pl. 4, figs. 64–66.

Sphaerodorum minutum Southern, 1914, p. 90, fig. 21.—Fauvel, 1923, p. 380, fig. 149,*a–c*.—Berkeley and Berkeley, 1948, p. 27, fig. 34.—Uschakov, 1955, p. 222, fig. 70.

Ephesiella minuta Chamberlin, 1920, p. 13.

DESCRIPTION.—Length up to 6 mm., width up to 1 mm., segments up to 30. Body may be thick set, short, oval when contracted or more elongated, widest in middle, tapering anteriorly and posteriorly. Ventral surface flat and narrow, dorsal surface strongly arched. Eyes two, under integument. Integument covered with minute papillae dorsally and ventrally. Spherical glandular capsules encircle the dorsum, in transverse rows in line with the parapodia, 10–14 per row (fig. 52,*d*,*e*). Parapodia elongated, with elongated papillae including 2 to 3 near distal tip. Setae few in number (4–9), compound, with shaft finely denticled near tip, with terminal blade slightly curved (fig. 52*f*). Aciculum colorless. Color: yellowish white, eyes black, eggs purplish red. Females may be filled with large oval eggs with thick smooth shells.

BIOLOGY.—Found at low water in holdfasts of *Laminaria*. Dredged on bottom of sand, mud, gravel, rocks, and shells. Mature specimens were taken in June, July, August in Ireland; some were taken in tow net at night (Southern).

MATERIAL EXAMINED.—Type of *Ephesia minuta* from Eastport, Maine. Also Gulf of St. Lawrence (Bay of Chaleurs, 50–61 fathoms), off Maine (*Albatross* III, 41°21′ N., 68°38′ W., meter net, 42 fathoms, December 15, 1955, R. L. Wigley).

DISTRIBUTION.—Scattered records in the Arctic (Spitsbergen, Canadian Arctic); also Ireland, Gulf of St. Lawrence to Maine. In low water to 61 fathoms; mature specimens in surface waters.

Superfamily Glycerea

Includes Glyceridae and Goniadidae. See the key to the families, p. 9.

Family Glyceridae

Body rounded, long (short compared with Goniadidae), smooth, fusiform, tapering gradually toward both ends. Body not divided into 2 regions (as in Goniadidae), either with only uniramous (*Hemipodus*) or only biramous parapodia (as *Glycera*). Segments biannulate or triannulate. Prostomium (figs. 53,*a,b*; 55*a*) small, sharply conical, transversely annulated. The distal ring with 4 minute, usually biarticulate antennae. The basal ring longer (peristomium fused with prostomium), with a pair of nuchal organs (appear as slits or, if everted, as papillae). With or without minute eyes in basal and distal rings.

First 1 or 2 segments usually with rudimentary uniramous parapodia. Uniramous parapodia supported by single aciculum with only compound spinigerous setae. Biramous parapodia (fig. 53,*c–f*) with rami poorly separated, supported by 2 acicula, the upper one with a group of simple notosetae, the lower one with compound spinigerous neurosetae arranged in a fan-shaped group. Dorsal cirri small globular; ventral cirri larger, conical; two anal cirri (fig. 55*b*). Branchiae present or absent; when present, they are thin-walled coelomic extensions; they may be saclike or digitiform, stationary or retractile, simple or branched. The branchiae are ciliated within, causing a streaming of the coelomic red blood cells toward the outside and tossing around in the center.

Proboscis (fig. 55,*a,d,e*) long (short compared to Goniadidae), strong, muscular, clavate, armed distally with 4, equally-spaced, large, dark, hooked horny jaws or paragnaths each with an attached embedded rodlike aileron. Surface of proboscis covered with numerous, crowded, small, nearly uniform papillae or proboscideal organs, giving a velvety aspect. The proboscis is a remarkable organ, serving the glycerids as an organ of special sense, with a remarkably well developed nervous system (Gravier, 1898).

Epitoky (swarming at maturity) has been described for a few species. When sexually mature, the entire individual becomes modified to form a swimming epitokous form, leaving the bottom and swimming actively at the surface.

The body may go through considerable changes associated with epitoky: The proboscis degenerates and is cast off, the intestine is in large part resorbed, and there may be a certain amount of muscle atrophy of the body wall. The parapodial lobes become elongated and the setae are elongated and augmented in number, some simple setae being formed among the compound setae. The elongation of the parapodia and setae takes place only when the sexual products are almost ripe; their bodies become distended by the fully developed gametes which fill the body cavity, and the animal is transformed into a veritable sac with eggs or sperm and swims to the surface, the sexual products are ejected from the mouth, the proboscis being absent.

The epitokous stage lasts but a short time; after spawning, the animals die (Fage and Legendre, 1927; Støp-Bowitz, 1941). Not all glycerids swarm (Klawe and Dickie, 1957, found no evidence for swarming in *Glycera dibranchiata*).

The glycerids or proboscis worms occur in sandy or muddy habitats and are active burrowers. The muscular system is very powerful and so arranged as to enable them to coil themselves into the shape of an open spiral, like a corkscrew, and then to rapidly rotate themselves on the axis of the spiral. When irritated, they apply the pointed head to the surface, and then by a vigorous thrust of the proboscis they penetrate a considerable space into the loose wet mud or sand. The body is then rotated with a screw-motion, and it penetrates with great rapidity and disappears almost instantly. They appear to be poor swimmers and seldom appear at the surface, spending almost all their time in the soil.

They are detritus feeders. Food is taken in by everting the proboscis, the large jaws being used to grasp particles. The proboscis, then, functions not only for grasping and ingesting food but for locomotion. Indigestible material is thrown off from the mouth.

There is no true blood vascular system; the coelomic fluid takes the place of blood and is propelled freely through the coelomic spaces, including the eversible proboscis and the branchiae, when present. The common name "bloodworm" is associated with the pinkish to red color given the body by the red coelomic fluid (hemoglobin in corpuscles in the coelomic fluid). They seem to be liable to wounds and ruptures and are irritable.

Contains only one New England genus.

Genus *Glycera* (Savigny, MS.) Lamarck, 1818

Rhynchobolus Claparède, 1868; type (herein designated): *Rhynchobolus convolutus* (Keferstein, 1862).

Euglycera Verrill, 1881; type (monotypy): *Euglycera dibranchiata* (Ehlers, 1868).

Type (monotypy): *Glycera unicornis* (Savigny, MS.) Lamarck, 1818.

The 4 species represented have the body cylindrical, thickest about anterior third, tapering slightly anteriorly and more so posteriorly. Prostomium (figs. 53,*a*,*b*; 55*a*) conical, longer than wide, rather obscurely transversely annulated with eight or more rings. Basal ring (peristomium fused with prostomium) with paired retractile nuchal organs (when everted, form prominent nuchal papillae). Distal ring with 4 small antennae. Basal part of prostomium, peristomium, and first few setigerous segments more or less fused and involved in the mouth ventrally (fig. 53*b*).

First 2 segments with parapodia rudimentary, without notopodia and dorsal cirri; rest of segments with biramous parapodia, each supported by two acicula (light colored and do not show through). Rami of parapodia not distinctly separated, appearing as a common lobe with 2 presetal and 1 to 2 postsetal distal lips. Notosetae simple, thin, capillary. Neurosetae compound, spinigerous (fig. 55*h*). Dorsal cirri small, globular. Ventral cirri elongate, conical. Anal segment small, with minute anus and with a pair of slender subulate anal cirri (fig. 55*b*).

Proboscis long, clavate, distally with 4 black hooked jaws; surface of proboscis beset with numerous, minute proboscideal organs. Color: flesh color except for the red coelomic fluid (red blood cells in coelomic fluid) which may give a pink, red or purple color to the body and proboscis, thus the name "bloodworms." The color varies in intensity with the movements of the blood in the body cavity. A red midventral streak present. Mature females pale brown; males cream colored.

Key to the New England Species of *Glycera*

1. Parapodia with a single postsetal lobe and 2 unequal presetal lobes (fig. 53,*c–f*). Globular dorsal cirri on dorsolateral body wall, well above the parapodia. Without branchiae . . . . **G. capitata**
   Parapodia with 2 presetal and 2 postsetal lobes (fig. 54, *a,b*). Globular dorsal cirri at dorsal base of parapodia. With branchiae 2
2. Branchiae retractile, emerging from posterodorsal side of parapodia; when fully extended, form digitiform branched lobes (fig. 54, *a,b*) . **G. americana**
   Branchiae nonretractile 3
3. Parapodia with 2 digitiform branchiae, above and below the setal lobe (fig. 55,*c,f,g*) . . . . **G. dibranchiata**
   With blisterlike branchiae on dorsoposterior bases of parapodia (fig. 54,*f,g*). **G. robusta**

Glycera capitata Oersted, 1843

FIGURE 53

Rhynchobolus capitatus Verrill, 1881, pp. 289, 296, 311, 316, 317.—Webster and Benedict, 1887, p. 726.—Whiteaves, 1901, p. 79.

Glycera capitata Sumner, Osburn, and Cole, 1913, p. 623.—Fauvel, 1923, p. 385, fig. 151, *a–e*.—Procter, 1933, p. 140.—Støp-Bowitz, 1941, p. 196, fig. 1; 1948b, p. 4.—Hartman, 1950, p. 76, pl. 11, figs. 1–4; 1956, pp. 251, 267; 1960b, p. 96.—Wesenberg-Lund, 1953, p. 48.—Pettibone, 1954, p. 272, fig. 31, *a–d*.—Uschakov, 1955, p. 171, figs. 46–47.

Hemipodia canadensis Treadwell, 1948, p. 40, fig. 25*d*.

DESCRIPTION.—Length up to 150 mm., width up to 8 mm., segments up to 150. Segments usually triannulate (may be biannulate or

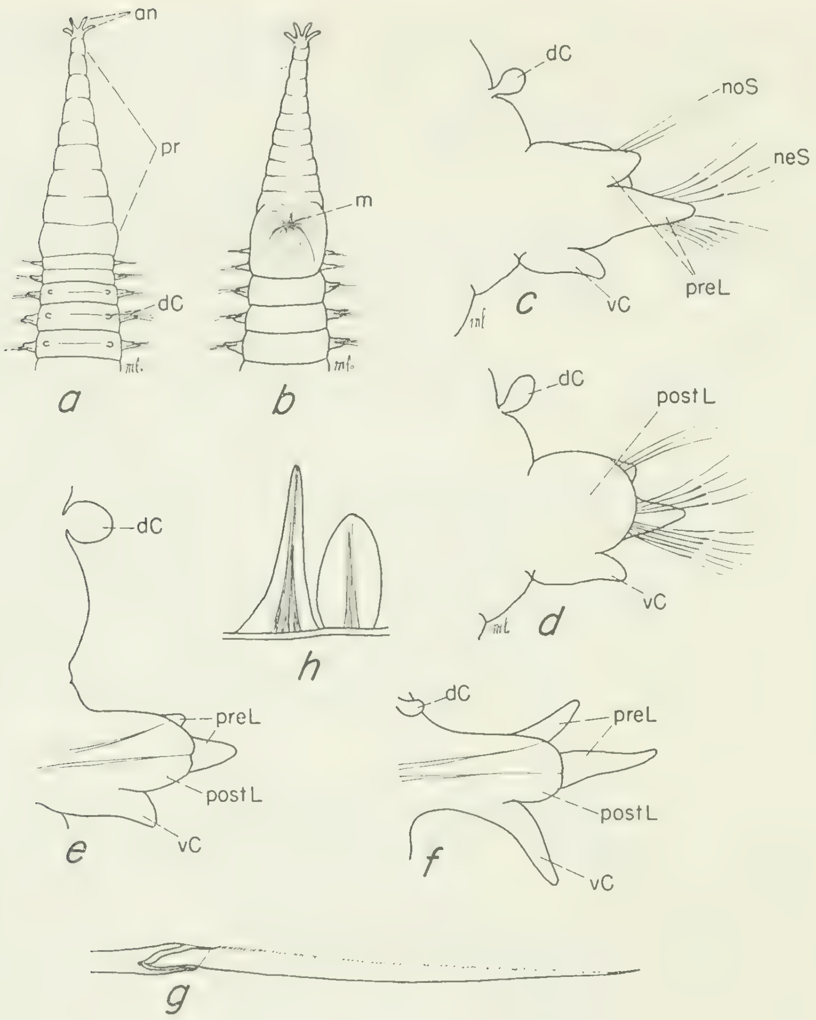

FIGURE 53.—Glyceridae, *Glycera capitata* (*e–h*, after Moore, MS.): *a*, dorsal view anterior end; *b*, same, ventral view; *c*, middle parapodium, anterior view; *d*, same, posterior view; *e*, parapodium from setiger 25, posterior view, setae omitted; *f*, same, from setiger 125; *g*, compound spinigerous neuroseta; *h*, the 2 forms of proboscideal papillae from ventral surface of protruded proboscis.

tetra-annulate). Parapodia (fig. 53*c–f*) with 2 conical presetal lips, the shorter upper one anterior to the notosetae and the longer lower one anterior to the fanshaped group of neurosetae. With single, short, rounded postsetal lobe (common to both notopodia and neuropodia). The relative lengths of the parapodial lobes may be variable, associated with the epitokous condition (Hartman, 1950). Proboscis with proboscideal organs of 2 kinds: Numerous, long, cylindrical to conical and fewer, shorter, subspherical ones (fig. 53*h*).

BIOLOGY.—Found at low water under stones on sandy shores. Dredged on bottoms of mud, sand, sandy clay, mud mixed with gravel, rocks, shells, worm tubes. Found in stomach of haddock (Georges Bank, 1953, 1954, 1955, R. Wigley). They form epitokes when sexually mature and may be found at the surface. This occurs from May to July in Norway (Støp-Bowitz, 1941; see discussion under Family).

MATERIAL EXAMINED.—Gulf of St. Lawrence (St. Lawrence estuary, south of Anticosti Island, 8–154 fathoms), Massachusetts (Georges Bank, 22–136 fathoms, R. Wigley; off Provincetown, 38 fathoms; 1 mile north Manomet Buoy, 17 fathoms; Massachusetts Bay, 2 miles from Cape Cod Canal, 10 fathoms).

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Faroes, Norway to Portugal, Azores, Madeira, Mediterranean, Adriatic, Davis Strait to Rhode Island, Alaska to Gulf of California and Mexico, Japan, South Atlantic, Antarctic. Low water to 1,889 fathoms; epitokous phase in surface waters.

***Glycera americana* Leidy, 1855**

FIGURE 54,*a–e*

Glycera americana Leidy, 1855, p. 147, pl. 11, figs. 49–50.—Treadwell, *in* Cowles, 1930, p. 344.—Hartman, 1944a, p. 336, pl. 16, fig. 1, pl. 18, fig. 2; 1945, p. 23; 1950, p. 73; 1951, p. 50.—Berkeley and Berkeley, 1948, p. 38, fig. 54.—Not Andrew, 1953, p. 9 (=*C. tesselata* Grube).—Reish, 1959, p. 82.—Knox, 1960b, p. 221, figs. 1–3.—Wesenberg-Lund, 1962, p. 100, figs. 44–46.

Rhynchobolus americanus Verrill and Smith, 1874, pp. 38, 48, 70, 77, 83, 134, 137, 140, 169, 302, pl. 10, figs. 45, 46.—Verrill, 1881, pp. 291, 296, 301, 317, 322.—Webster, 1879, p. 245; 1886, p. 145.—Andrews, 1891a, p. 289.—Sumner, Osburn, and Cole, 1913, p. 623.

DESCRIPTION.—Length up to 350 mm., width up to 13 mm., segments up to 300. Parapodia (fig. 54,*a*,*b*) with 4 sharply conical lips, the 2 presetal ones slightly longer than the 2 postsetal ones. Branchiae retractile, thin walled, emerging from a pore on the posterior face of the parapodial lobe at about the level of the dorsal cirrus. When fully extended, the branchiae form a conspicuous arborescent bushy tuft with a short base which bifurcates several times (when not fully everted, may have all stages of few to numerous, digitiform branchiae showing). Proboscis with proboscideal organs of two kinds: more numerous, smaller, subconical (fig. 54*d*) and fewer, larger, ovate to subspherical ones (fig. 54*e*).

BIOLOGY.—Found at low water in sandy beaches, mud, sandy mud, in oyster beds. Common in the sandy shoals where the sand is mixed with some mud, gravel and shell particles, usually in areas less aerated than where *G. dibranchiata* occurs. Dredged on muddy bottoms of bays and sounds and in brackish waters. Sexually mature males have been found swimming at the surface in the evening in Massachusetts in July and August (Vineyard Sound, August 26, 1875, Verrill; Eel Pond,

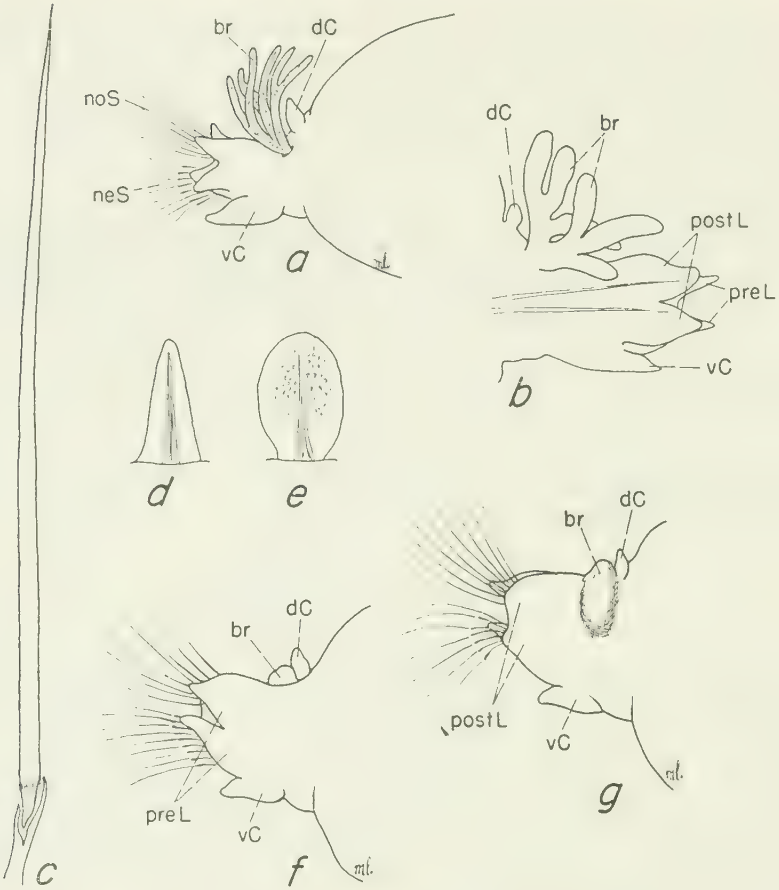

Figure 54.—Glyceridae, *a–e*, *Glycera americana* (*b–e*, after Moore, MS.): *a*, middle parapodium, posterior view; *b*, parapodium from setiger 35, posterior view, setae omitted; *c*, compound spinigerous neuroseta; *d*, proboscideal organ or papilla from ventral surface of proboscis, subconical kind; *e*, same, ovate kind. *f–g*, *Glycera robusta:* *f*, middle parapodium, anterior view; *g*, same, posterior view.

Woods Hole, August 15, 1943, and August 30, 1944, D. P. Costello; Fisheries Dock, Woods Hole, July 26, 1954; Woods Hole Oceanographic pier, August 22, 1959, M. Simpson). Verrill records taking the young in surface tow in early September. According to Moore (MS.), it breeds throughout the summer, but fully mature individuals are most frequently obtained in August in both atokous and epitokous states (in the latter condition, setae are longer, more numerous and spreading).

Material examined.—Numerous specimens from Massachusetts (Woods Hole region, Nantucket Sound, Elizabeth Islands), Rhode Island, Long Island Sound, Maryland (Chesapeake Bay), Virginia (Chincoteague Bay), North Carolina (Beaufort), South Carolina

(Parris Island), Florida (Seahorse Key, off Tampa), Washington (Puget Sound), low water to 45 fathoms.

Distribution.—Massachusetts (Buzzards Bay and Vineyard Sound) to Florida, Gulf of Mexico, south to Brazil and Argentina; western Canada (Vancouver Island) to Lower California, Mexico, south to Peru; Straits of Magellan, New Zealand, South Australia. Low water to 172 fathoms; sexual forms in surface waters.

***Glycera dibranchiata* Ehlers, 1868**

Figure 55

Glycera dibranchiata Ehlers, 1868, p. 670, pl. 24, figs. 1, 3–8, 10–28.—Not Treadwell, 1924, p. 14 (=*G. sphyrabrancha* Schmarda).—Treadwell, *in* Cowles, 1930, p. 344.—Procter, 1933, p. 140.—Hartman, 1944a, p. 339, pl. 18, fig. 1; 1945, p. 23; 1950, p. 70, pl. 10, figs. 9, 10; 1951, p. 50.—Gustafson, 1953, p. 7.—MacPhail, 1954, p. 11, fig. 3.—Dow and Wallace, 1955, p. 1.—Renaud, 1956, p. 19, fig. 15.—Klawe and Dickie, 1957, p. 1, figs. 1–18.—Rioja, 1958, p. 258.—Stickney, 1959, p. 17.

Rhynchobolus dibranchiatus Verrill and Smith, 1874, pp. 38, 47, 70, 77, 83, 134, 137, 140, 169, 302, pl. 10, figs. 43–44.—Webster, 1879, p. 245; 1886, p. 146.

Euglycera dibranchiata Verrill, 1881, pp. 296, 301, 304, 308, 322.—Webster and Benedict, 1884, p. 723; 1887, p. 726.—Sumner, Osburn, and Cole, 1913, p. 623.—Andrews, 1891a, p. 288.

Description.—Length up to 370 mm., width up to 11 mm., segments up to 300. Parapodia (fig. 55,*c*,*f*,*g*) with 2 sharply conical presetal lobes throughout the length of the body. Two shorter, bluntly conical postsetal lobes in the anterior region, the upper one being shorter, rounded and the lower one longer, bluntly conical; in the middle region the 2 postsetal lobes are both bluntly conical, the upper one shorter than the lower one. In the posterior parapodia, there may be a single rounded postsetal lobe with a conical tip. Branchiae 2, digitiform to ligulate, nonretractile; the upper one occurs between the dorsal cirrus and notopodium, the lower one occurs anterior to the ventral cirrus; they are thin walled and contractile, with a thin layer of spiral muscle fibers. Proboscis with proboscideal organs all similar, small, conical, flattened, with a central core and surface marked with oblique furrows (fig. 55*e*).

Biology.—Found at low water and dredged in deeper water on bottoms of sand, mud, mud mixed with gravel, rocks, and particularly in mud rich in detritus. Found in more exposed beaches than where *G. americana* occurs, especially where the current flows swiftly. Found in brackish waters and tidal estuaries. According to the observations of Klawe and Dickie (1957), it is usually not found deeper than 25 cm. and is more abundant in soft mud rich in organic materials; relatively few were found in hard soils. It is a detritus feeder, the food being retained and digested in the anterior portion of

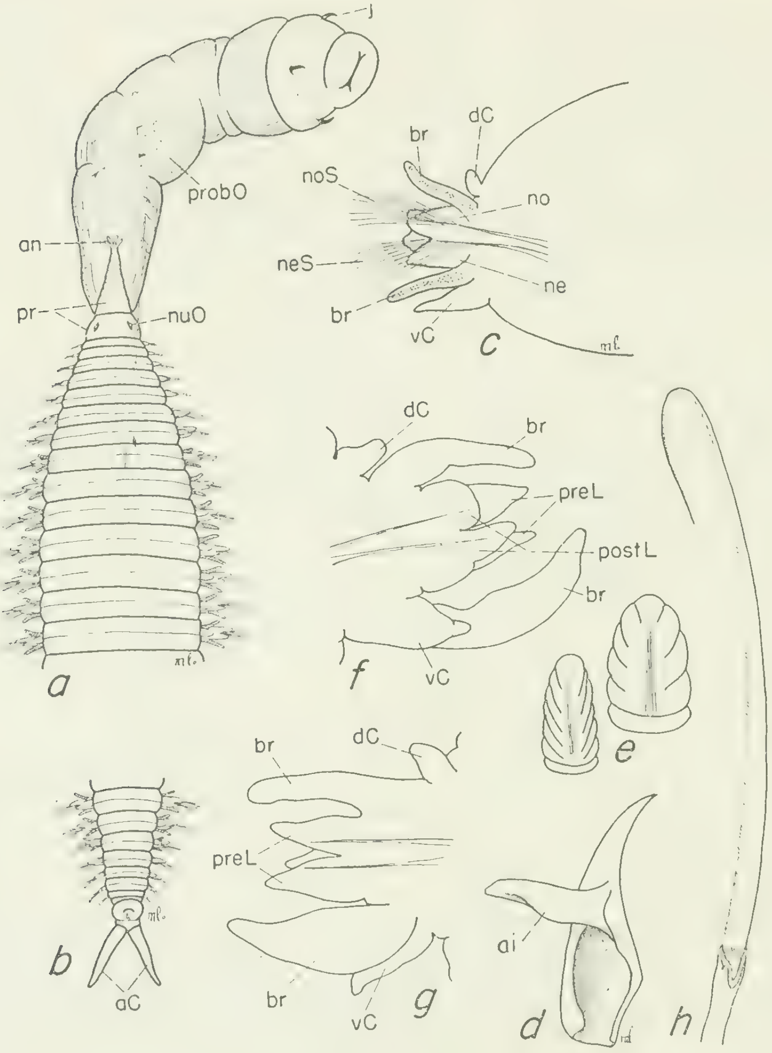

Figure 55.—Glyceridae, *Glycera dibranchiata* (*e–h*, after Moore, MS.): *a*, dorsal view anterior end with proboscis extended; *b*, dorsal view posterior end; *c*, middle parapodium posterior view; *d*, jaw with attached aileron; *e*, 2 proboscideal organs or papillae from surface of extended proboscis; *f*, posterior view parapodium from setiger 25, setae omitted; *g*, anterior view parapodium from setiger 100, setae omitted; *h*, compound spinigerous neuroseta from setiger 15.

the digestive tract. Ingested material was found in the form of pellets up to 30 mm. long, of amorphous material of mud, sand, and decaying organic matter. Undigested material was regurgitated through the mouth. They move about considerably on the flats by burrowing; there is no evidence that swimming is an important means of movement. They seldom crawl on the surface of the mud or travel long distances by swimming, as do the sandworms (*Nereis virens*). Their excursions into new territory are slow.

G. dibranchiata is 1 of the 2 (along with *Nereis virens*) common commercially valuable marine bait worms in the Maritime Provinces and in Maine, where it is known as the "bloodworm" or "beakthrower," because of its habit of extending and retracting the proboscis when handled. The minimum marketable length is about 6 inches. According to Dow and Wallace (1955), bloodworms can apparently tolerate conditions which are unfavorable for both sandworms and quahogs. They are found further upstream than clams in the tidal rivers. Areas affected by considerable amounts of fresh water runoff may be barren of shellfish and sandworms but will be occupied by bloodworms. They were found in the stomach of haddock (Georges Bank, 1953, R. Wigley).

Klawe and Dickie (1957) made observations on a population of *G. dibranchiata* from Goose Bay at Wedgeport, Nova Scotia. They found that in the sexually mature worms, or "spawners," the muscles of the body wall and of the proboscis undergo histolysis, such that they become thin walled and fragile and the digestive tract breaks down. Eggs and sperm begin development in late summer and are sexually mature by early April (fully developed eggs between 180μ and 190μ in diameter). The breeding season is restricted to a few weeks in the spring, the peak of the spawning taking place in the middle of May. Spawning was not observed, but remains of spent worms were found on the flats, appearing as "ghost worms," consisting of the outer skin and atrophied digestive tract with everted proboscis, indicating that life terminates after spawning. There was no evidence for swarming at spawning time.

Their early development was also followed. They develop into planktonic larvae for a time before being transformed into bottom dwellers, but it does not seem likely that they are pelagic during much of their development. From an analysis of the distribution of size classes in the population, Klawe and Dickie surmised that most of the intertidal population lives for 3 years and that they spawn before reaching the fourth year; a small fraction spawn when 4 or 5 years old. Growth is most rapid in the second and third years, decreasing sharply thereafter. According to Moore (MS.) in the Woods Hole region, they breed during the summer but ripe individuals are seldom met with; epitokous individuals are very rare (Klawe and Dickie suggest that they were tardy spawners).

Adults have been observed swimming at the surface: Eel Pond, Woods Hole, evening, August 17, 1943, J. B. Buck; Woods Hole, surface, January 28, 1876, Verrill; Delaware Bay, January 29, 1957, T. Hopkins.

MATERIAL EXAMINED.—Numerous specimens from Gulf of St. Lawrence (Bay of Chaleurs, low water to 12 fathoms), Nova Scotia

(Cape Breton), New Brunswick (St. Andrews), Maine (Robbinston, St. Croix; Glen Cove, Penobscot Bay; Rockland; Sheepscot River in Boothbay Harbor region; Waites Landing, Casco Bay), New Hampshire (Emerson's Beach, mouth Oyster River; Little Bay), Massachusetts (Georges Bank, 37–50 fathoms; Plum Island; Essex; Marblehead; Duxbury; Cape Cod, Barnstable, Orleans, Wellfleet, Cape Cod Bay; Woods Hole region; Elizabeth Islands; Nantucket Sound), Rhode Island, Delaware (Delaware Bay), Maryland (Chesapeake Bay), Virginia (Chincoteague Bay), North Carolina (Beaufort), Florida (Seahorse Key).

DISTRIBUTION.—Gulf of St. Lawrence to Florida, Gulf of Mexico (Florida, Texas), central California to Lower California and Mexico. Low water to 220 fathoms.

Glycera robusta **Ehlers, 1868**

FIGURE 54,*f–g*

Glycera robusta Ehlers, 1868, p. 656, pl. 24, figs. 31–32.—Berkeley and Berkeley, 1948, p. 39, fig. 55; 1954, p. 461; 1960, p. 358.—Hartman, 1950, p. 69, pl. 10, figs. 7–8.—Klawe and Dickie, 1957, p. 2.

DESCRIPTION.—Length up to 800 mm., width up to 22 mm., segments very numerous. Parapodia with 2 conical subequal presetal lobes, the 2 lobes separated by a deep notch; with 2 low, rounded to slightly conical postsetal lips with only a slight notch between (may be entire). Branchiae in the form of blisterlike, dilatable, clear areas on the dorsal and posterodorsal surfaces between the dorsal cirri and the bases of the parapodial lobes (fig. 54,*f*,*g*). Proboscis with proboscideal organs similar, pear shaped.

BIOLOGY.—Found close to the low water mark and dredged on bottoms of mud, sandy mud with gravel. Rarely taken, as it lives rather deep in the mud, 30 cm. or more, according to W. L. Klawe. Found in the stomach of haddock (Georges Bank, 1954, R. Wigley).

MATERIAL EXAMINED.—Gulf of St. Lawrence (Laurentian Channel, 206 fathoms), Maine (Newcastle, 1952, Ivan Flye; Boothbay Harbor), Massachusetts (Georges Bank, 32–37 fathoms, R. Wigley; Nantucket Sound), Virginia (Chincoteague Bay area, S. McDowell), British Columbia (Barclay Sound), Washington (west side San Juan Island).

DISTRIBUTION.—Alaska (Queen Charlotte Islands) to Gulf of California, Japan, Gulf of St. Lawrence to Virginia (Chincoteague Bay), Florida (?). Low water to 206 fathoms.

Family Goniadidae

Body long and slender, more or less attenuated at both ends, divided into 2 or 3 regions: a shorter anterior region with uniramous parapodia (fig. 56,*b*,*i*); a longer and usually wider posterior region with biramous parapodia and rami well separated (fig. 56,*c,j*); and with or without an intermediate transitional region in which the notopodia develop gradually. Segments uniannulate. Prostomium (figs. 56,*a,h*; 58,*a,b*) long, conical, transversely annulated. The small distal ring with 4 small, usually biarticulated antennae; basal ring wider (peristomium fused with prostomium), with a pair of nuchal organs. With or without paired minute eyes in basal ring and distal or subdistal ring. Basal ring of prostomium, peristomium, and first few setigerous segments more or less fused and involved in mouth ventrally.

Parapodia of first segment rudimentary or smaller than following. Uniramous parapodia with neuropodial presetal and postsetal lobes, with well developed conical to ligulate dorsal and ventral cirri. Biramous parapodia with smaller conical notopodium. Notosetae simple, numerous and hairlike or few and acicular. Neurosetae compound spinigers (fig. 56*l*) and sometimes also compound falcigers. Branchiae absent.

Proboscis eversible, extremely long, cylindrical. When fully extended, distal end with a circlet of soft papillae within which are a circlet of numerous, dark, hard, chitinous paragnaths including a pair of larger jaws or macrognaths with a varying number of acute, clawlike teeth and H- or Y-shaped micrognaths arranged in a dorsal and ventral arc (fig. 58*d*). With or without additional dark horny V-shaped jaw pieces arranged bilaterally on the basal part of the proboscis, the so-called chevrons (fig. 58*c*). The surface of the proboscis more or less covered with small papillae, or proboscideal organs, fleshy or horny, yellow or colorless, minute, scalelike, and similar to larger, spinelike, and heterogeneous (fig. 56*h*; for detailed study of proboscideal organs, see Hartman, 1950).

When sexually mature, they may become modified to an epitokous swimming form. There is no change in the anterior uniramous region and the proboscis remains intact (thus differs from the glycerids). In the posterior region where the sex products are found, the parapodial lobes become more elongate and additional, much longer simple setae are crowded among the compound neurosetae. The intestine is broken down posteriorly (Støp-Bowitz, 1941). They are mostly subintertidal, burrowing in the mud or soft bottom. They are active and predaceous.

Key to the New England Genera of Goniadidae

1. Neuropodial presetal lobes simple (fig. 56,*b,c,i,j*) 2
Neuropodial presetal lobes bilobed (may be simple on some anterior segments, fig. 58*f*) 3

2. Proboscis with bilateral series of chevrons near base; surface of proboscis covered with numerous similar proboscideal organs; neurosetae both compound falcigers and spinigers . . . . **Goniadella**
   Proboscis without chevrons; surface of proboscis with longitudinal series of horny spinous proboscideal organs of remarkable diversity, grossly resembling a radula of agast ropod (fig. 56*h*); neurosetae compound spinigers only (fig. 56*l*) . . . . **Glycinde**
3. Proboscis with bilateral series of chevrons near base (fig. 58*c*) . . . . . **Goniada**
   Proboscis without chevrons. . . . . **Ophioglycera**

Genus *Goniadella* Hartman, 1950

Type (monotypy): *Goniadella gracilis* (Verrill, 1873a). Contains only one New England species.

Goniadella gracilis (Verrill, 1873a)

FIGURE 56,*a–g*

Eone gracilis Verrill, 1873a, pp. 598, 596.
Goniada gracilis Verrill, 1879, p. 174.—Webster and Benedict, 1884, p. 723, pl. 5, figs. 49–52.—Hartman, 1944a, p. 339, pl. 15, fig. 2, pl. 18, fig. 3.
Goniadella gracilis Hartman, 1950, p. 42, pl. 5, figs. 4–8.

DESCRIPTION.—Length up to 50 mm., width up to 1 mm., segments up to 100 or more. Prostomium (fig. 56*a*) distinctly annulated, including wide basal ring (fused prostomium and peristomium) and 7–8 more distal rings. With a pair of eyespots in the basal ring and often a subdistal pair (in third ring from the end). With 4 slender, ringed antennae. First pair parapodia rudimentary.

Anterior region (fig. 56*b*) with about 30 segments (27–32), with dorsal and ventral cirri elongate, triangular, with postsetal lobe blunt and entire, of about same length as cirri, with presetal lobe simple, conspicuously longer, often tending to stand erect. Neurosetae delicate, colorless, compound spinigers and falcigers (fig. 56*d*). Posterior region (fig. 56*c*) with an additional small inconspicuous notopodial lobe at the base of the dorsal cirri, with a few (2–4) simple acicular notosetae sometimes extending out about as far as the dorsal cirri.

Proboscis covered with minute papillae or proboscideal organs of a single kind; in addition, with bilateral series of chevrons on the basal part of the proboscis (fig. 56*e*), about 26 in each series, closely spaced. Paired dentate macrognaths present having 3–4 teeth (fig. 56*f*); micrognaths H-shaped (fig. 56*g*), about 10 in the dorsal arc and 3 larger ones in the ventral arc. Color: iridescent pale red or yellowish white.

BIOLOGY.—Found burrowing in fine sand at low water. Dredged on bottoms of fine gravel, fine to coarse sand, and soft mud. Because

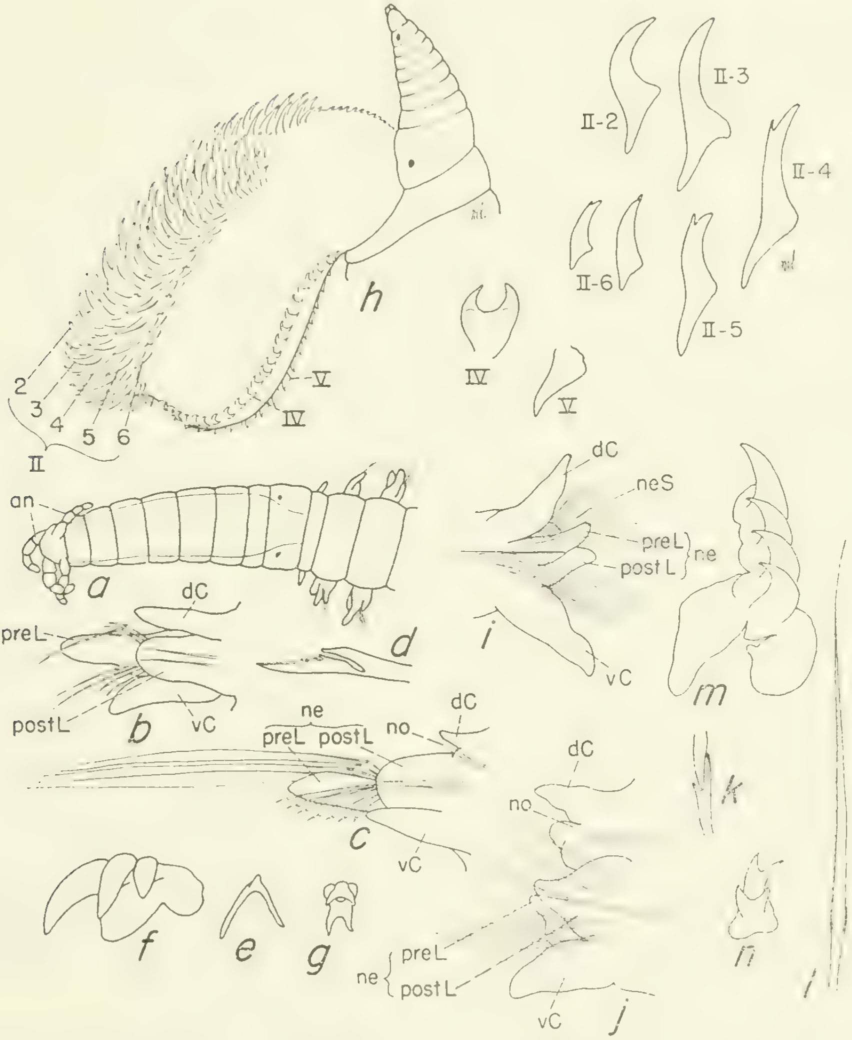
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FIGURE 56.—Goniadidae, *a–g*, *Goniadella gracilis* (after Moore, MS.): *a*, dorsal view anterior end; *b*, anterior uniramous parapodium from setiger 10, posterior view; *c*, middle biramous parapodium from setiger 50, posterior view; *d*, compound falcigerous neuroseta from setiger 10; *e*, 1 of chevron jaw pieces of proboscis; *f*, large jaw or macrognath of proboscis; *g*, 1 of larger micrognaths of proboscis. *h–n*, *Glycinde solitaria* (*i–n*, after Moore, MS.): *h*, lateral view anterior end showing base of proboscis with different kinds of proboscideal organs; *i*, anterior uniramous parapodium from setiger 10, anterior view; *j*, middle biramous parapodium from setiger 30, posterior view; *k*, articulation of subacicular compound spinigerous neuroseta from setiger 10; *l*, same, three-fourths facial view; *m*, macrognath of proboscis; *n*, micrognath of proboscis.

of their small size, they easily escape notice. According to Webster and Benedict (1884), they are active in confinement, moving rapidly and throwing themselves into coils, similar to *Glycera*. They have been found in the stomach of haddock (Georges Bank, 1953, 1954, R. Wigley).

Material examined.—Massachusetts (Georges Bank, 18–47 fathoms) and off Rhode Island.

Distribution.—Massachusetts to off Rhode Island. Low water to 47 fathoms.

Genus *Glycinde* Müller, 1858

Type (monotypy): *Glycinde multidens* Müller, 1858. Contains only one New England species.

Glycinde solitaria (Webster, 1879)

Figure 56,*h–n*

Goniada solitaria Webster, 1886, p. 146, pl. 7, figs. 41–42, pl. 8, figs. 43–44.

Goniada oculata Treadwell, 1901b, p. 201, figs. 50–53.—Treadwell, *in* Cowles, 1930, p. 344.

Glycinde solitaria Hartman, 1945, p. 23; 1950, p. 54, pl. 7, figs. 1–15.

Description.—Length up to 35 mm., width up to 1.3 mm., segments up to 150. Prostomium acutely conical with 9 rings, with 4 minute slender antennae, with 2 pairs minute eyes, a pair in basal ring and a pair in distal ring. Anterior region (fig. 56*i*) with 24–25 segments, with dorsal and ventral cirri large and conical, and with presetal and postsetal neuropodial lobes long, narrow, about equal in length to cirri. Neurosetae long, compound spinigers forming a fan-shaped group (fig. 56,*k*,*l*).

Posterior region slightly wider and more flattened, with parapodia (fig. 56*j*) becoming gradually biramous, the notopodial lobe forming a small inconspicuous low lobe, gradually increasing in size posteriorly. Notosetae few (3–6), acicular, falcate and hooded. Neuropodial lobe larger and longer than in anterior segments, the presetal lobe long, surpassing the postsetal lobe. Dorsal cirri smaller than on anterior segments. Anal cirri long, filiform.

Proboscis (fig. 56*h*) with surface papillae, or proboscideal organs, heterogenous, in longitudinal rows consisting on each side of 6 dorsolateral rows of long hooks (zone II), a lateral row of 2–4 knobbed organs (zone IV), a ventrolateral row of hooks (zone V). A pair of dentate macrognaths present with 4 or 5 teeth (fig. 56*m*). About 10 micrognaths present in dorsal arc (fig. 56*n*), none in the ventral arc. Color: pale yellowish or gray, tinged with green.

Biology.—Found at low water in mud and sandy shoals. Dredged on bottoms of mud. Due to its small size, it may easily be overlooked.

Material examined.—Maryland (Chesapeake Bay, low water to 26 fathoms).

Distribution.—New Jersey, Maryland (Chesapeake Bay), North Carolina, Puerto Rico. In low water to 26 fathoms.

Genus *Ophioglycera* Verrill, 1885b; emend. Hartman, 1950

Type (monotypy): *Ophioglycera gigantea* Verrill, 1885b. Contains only one New England species.

Ophioglycera gigantea Verrill, 1885b

FIGURE 57,*c–e*

Ophioglycera gigantea Verrill, 1885b, p. 436.—Hartman, 1944a, p. 339, pl. 15, fig. 1, pl. 18, fig. 4, pl. 25, fig. 1; 1950, p. 37, pl. 5, figs. 1–3.—Berkeley and Berkeley, 1954, p. 460.

Ophioglycera grandis Verrill, 1885a, pl. 42, fig. 185.

DESCRIPTION.—Length up to 760 mm., width up to 14 mm., segments up to 300. Prostomium bluntly conical, annulate, with 8–9 rings, with 4 short antennae. Basal ring (fused peristomium with prostomium) long, with a pair of dorsolateral grooves and with or without a pair of small lateral eyes. First pair parapodia rudimentary. Anterior region (fig. 57*c*) consists of about 58 segments (56-64), with dorsal and ventral cirri and postsetal neuropodial lobes, similar ligulate. Presetal lobes bilobed, digitiform, slightly shorter than the postsetal lobes. Neurosetae compound spinigers forming a spreading bundle. With a transitional region of about 20 segments where the notopodia develop gradually.

The fully developed posterior region begins on about segment 81 (78–90) where the segments are wider and somewhat flattened dorsoventrally, and the parapodial rami are well separated (fig. 57, *d,e*). Dorsal cirri broad and flattened. Notopodial lobes with presetal triangular lobes, similar in length to dorsal cirri and postsetal short rounded lobes. Notosetae simple, short, capillary, nearly hidden by the setigerous lobe. Neuropodial lobes with presetal lobes bilobed with conical tips and postsetal lobes rounded, with narrowed triangular tips. Neurosetae and ventral cirri as in anterior region. Two small anal cirri.

Proboscis with surface covered with minute papillae or proboscideal organs, without chevrons, with a pair of dentate macrognaths each with about 5 teeth, with a circlet of micrognaths. Color, in life: pink flesh; preserved: brilliant metallic lustre.

BIOLOGY.—Found at low water on mud flats and on gravelly mud. Dredged on bottoms of mud, muddy sand with stones and broken shells. Mature large specimen found swimming at the surface (type specimen of Verrill). It is one of the largest species of goniadids.

MATERIAL EXAMINED.—Nova Scotia (Two Islands near Parrsboro, east side Partridge Island), New Brunswick (St. Andrews, near Biological Station, low water, July 1958), Rhode Island (Narragansett

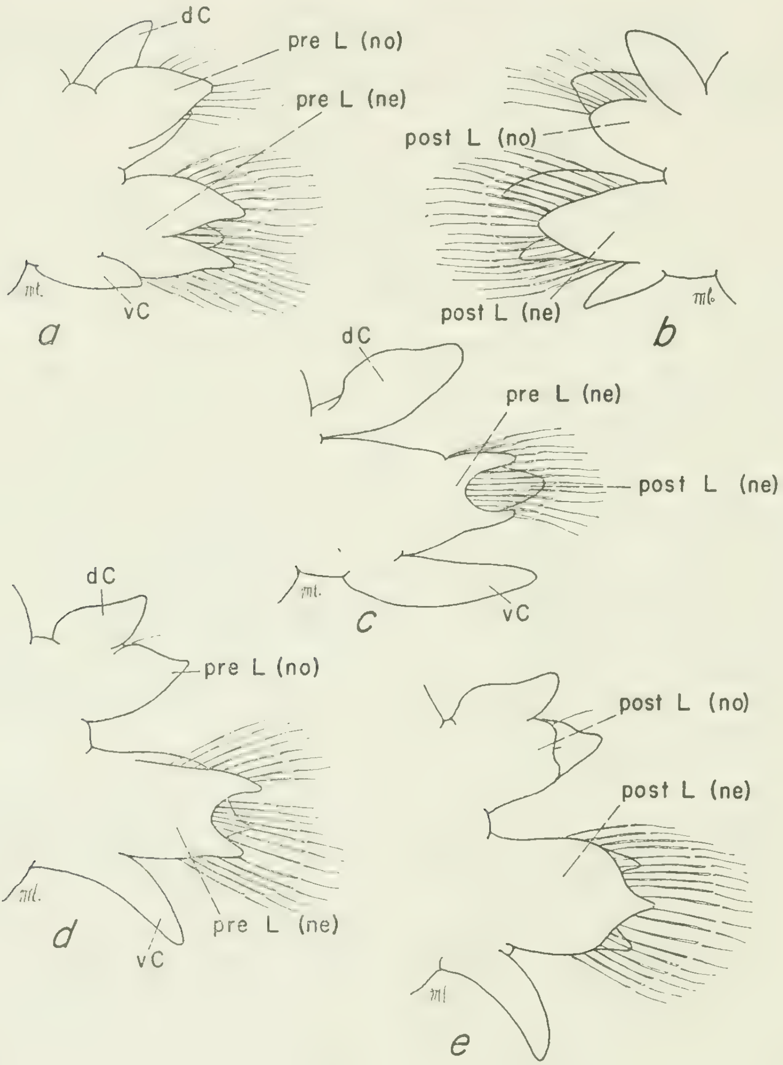
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Figure 57.—Goniadidae, *a–b*, *Goniada brunnea: a*, posterior biramous parapodium, anterior view; *b*, same, posterior view. *c–e*, *Ophioglycera gigantea: c*, anterior uniramous parapodium, anterior view; *d*, posterior biramous parapodium, anterior view; *e*, same, posterior view.

Bay, U.S. Fish. Commission Location 841, 21 fathoms, 1880; Location 847, 12 fathoms, 1880).

Distribution.—Nova Scotia to off Rhode Island, Antarctic. Low water to 25 fathoms; sexual forms at surface.

Genus *Goniada* Audouin and Milne-Edwards, 1833b

Type (monotypy): *Goniada emerita* Audouin and Milne-Edwards, 1833b.

The 3 species represented have the prostomium conical, annulate, with 8–11 rings, with longer basal ring (peristomium fused with prostomium), with 4 small biarticulate antennae (fig. 58,*a–b*). Parapodia of first segment smaller than following. Neurosetae compound spinigers arranged in fan-shaped groups. Notosetae simple, slender, hairlike, arranged in fan-shaped groups. Two subulate anal cirri. Proboscis cylindrical with surface covered with minute papillae or proboscideal organs, with bilateral series of chitinous, dark, V-shaped chevrons near base (fig. 58*c*).

Key to the New England Species of *Goniada*

1. Neuropodial presetal lobe of anterior region (at least up to segment 18) entire, not bilobed (fig. 58*e*); anterior uniramous region of about 39 segments (38–40), with no intermediate region; proboscis with a series of about 9 chevrons (7–11) . . . . **G. maculata**

   Neuropodial presetal lobe of anterior region bilobed from segment 3 on (fig. 59*a*); proboscis with a series of about 18 chevrons (13–21) 2
2. Anterior uniramous region of about 34 segments (33–37), with a long intermediate region up to about segments 80–85 . . . . **G. norvegica**

   Anterior uniramous region of about 44 segments (38–50), with almost no intermediate region . . . . **G. brunnea**

Goniada maculata Oersted, 1843

Figure 58

Goniada maculata Verrill, 1881, pp. 289, 297, 299, 304, 308, 311, 316.—Webster and Benedict, 1887, p. 726.—Whiteaves, 1901, p. 79.—Fauvel, 1923, p. 392, fig. 154,*a–g*.—Procter, 1933, p. 141.—Day, 1934, p. 48; 1960, p. 333.—Annenkova, 1937, p. 166; 1938, p. 165.—Støp-Bowitz, 1941, p. 209, fig. 7,*a–g*; 1948b, p. 9.—Wesenberg-Lund, 1949, p. 296; 1950a, p. 24; 1950b, p. 66; 1951, p. 51.—Hartman, 1950, p. 20, pl. 1, figs. 7–8.—Uschakov, 1955, p. 173, fig. 48.—Clark, 1960, p. 22.

Description.—Length up to 100 mm., segments up to 200. Anterior uniramous region of about 39 segments (38–40). Parapodia (fig. 58*e*) with dorsal and ventral cirri elongate, with presetal lobe longer, digitiform, single up to about segment 18, unequally bilobed up to the posterior region. Postsetal lobe shorter, rounded. Posterior biramous region wider, more flattened, with parapodial rami well separated (fig. 58,*f,g*). Dorsal cirri large, flattened. Notopodium with conical presetal lobe about same length as dorsal cirri, without postsetal lobe. Neuropodium with postsetal lobe wide, short, lanceolate, with presetal lobe longer, bilobed with lobes subequal, pointed.

Proboscis (fig. 58,*c,d*) with bilateral series of about 9 chevrons (7–11). Distal part with 2 dentate macrognaths each with 5–8 teeth. Three X-shaped micrognaths in ventral arc and 4 smaller Y-shaped ones in dorsal arc. Color: light green to bright lemon yellow; anterior end greenish, orange more posteriorly.

Biology.—Found at low water and dredged on bottoms of clay, mud, mud mixed with sand, fine gravel, rocks, shells, and worm tubes. Found in the stomach of cod and haddock at St. Andrews (McIntosh, 1910), in the stomach of haddock on Georges Bank (1953, 1955, R. Wigley), and in the stomach of the plaice *Hippoglossoides platessoides* (Bay of Chaleurs, July 27, 1957).

Material examined.—Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, 5–44 fathoms), off Nova Scotia, Maine, Massachusetts, Rhode Island (13 to 1,255 fathoms), off Lower California (44 fathoms).

Distribution.—Scattered records in the Arctic (Greenland, Davis Strait). Also Norway, Iceland, Faroes to North Sea, English Channel, Spain, Portugal, Madeira, Gulf of Iran, Gulf of St. Lawrence to off Rhode Island, north Japan Sea to Japan, Alaska, off Lower California, South Africa. Low water to 1,255 fathoms.

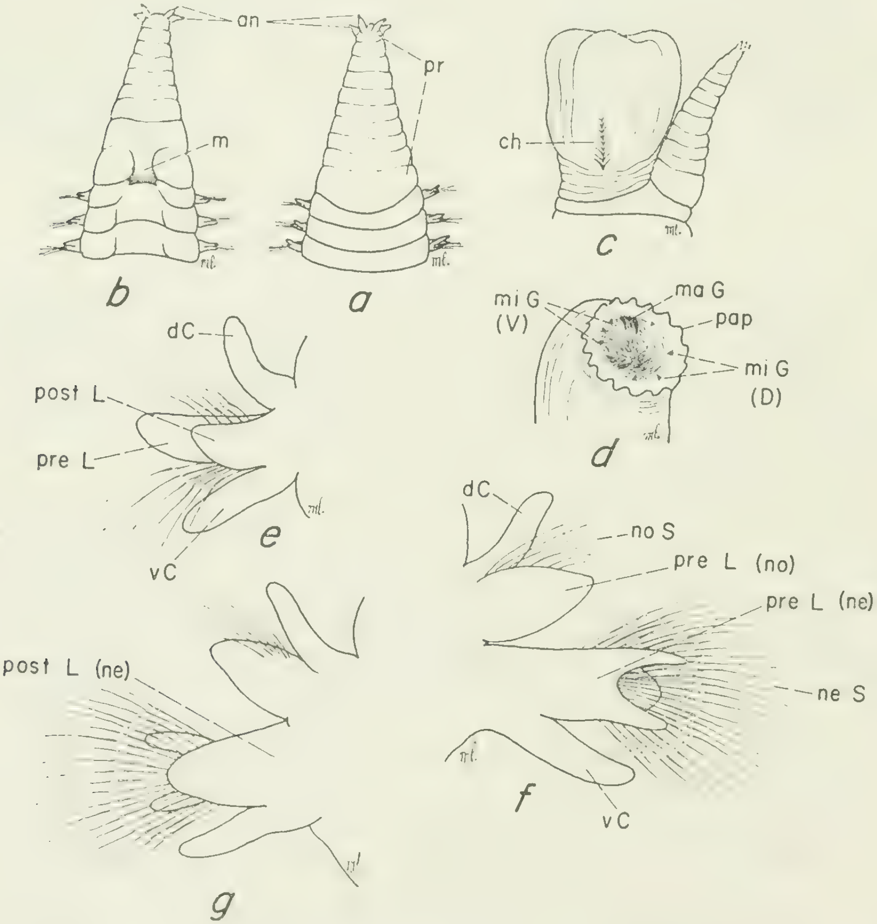

Figure 58.—Goniadidae, *Goniada maculata: a*, dorsal view anterior end; *b*, ventral view anterior end; *c*, lateral view anterior end with proboscis partially everted; *d*, distal part of everted proboscis; *e*, anterior uniramous parapodium, posterior view; *f*, posterior biramous parapodium, anterior view; *g*, same, posterior view.

Goniada norvegica Oersted, 1845a

FIGURE 59

Goniada norvegica Fauvel, 1923, p. 393, fig. 155,*a–g*; 1934, p. 44.—Støp-Bowitz, 1941, p. 213, fig. 8; 1948b, p. 9.—Wesenberg-Lund, 1950a, p. 25; 1951, p. 51.—Fauvel and Rullier, 1959, p. 533.—Clark, 1960, p. 22.—Eliason, 1962, p. 249.

Goniada quinquelabiata Hartman, 1950, p. 26.

DESCRIPTION.—Length up to 300 mm., width up to 9 mm., segments up to 300. Anterior region (fig. 59,*a,b*) of about 34 segments (33–37). Dorsal and ventral cirri and lobes of neuropodia of about same length. Neuropodium with equally bilobed presetal lobes and entire postsetal lobes. A long intermediate transitional region extends to about segments 80–85, with the notopodia gradually increasing in size, the parapodial rami not widely separated. Posterior biramous region wider, with parapodial rami widely separated (fig. 59,*c,d*). Dorsal cirri thick, foliaceous. Notopodium with presetal lobe pointed and postsetal lobe shorter, obtuse. Neuropodium with

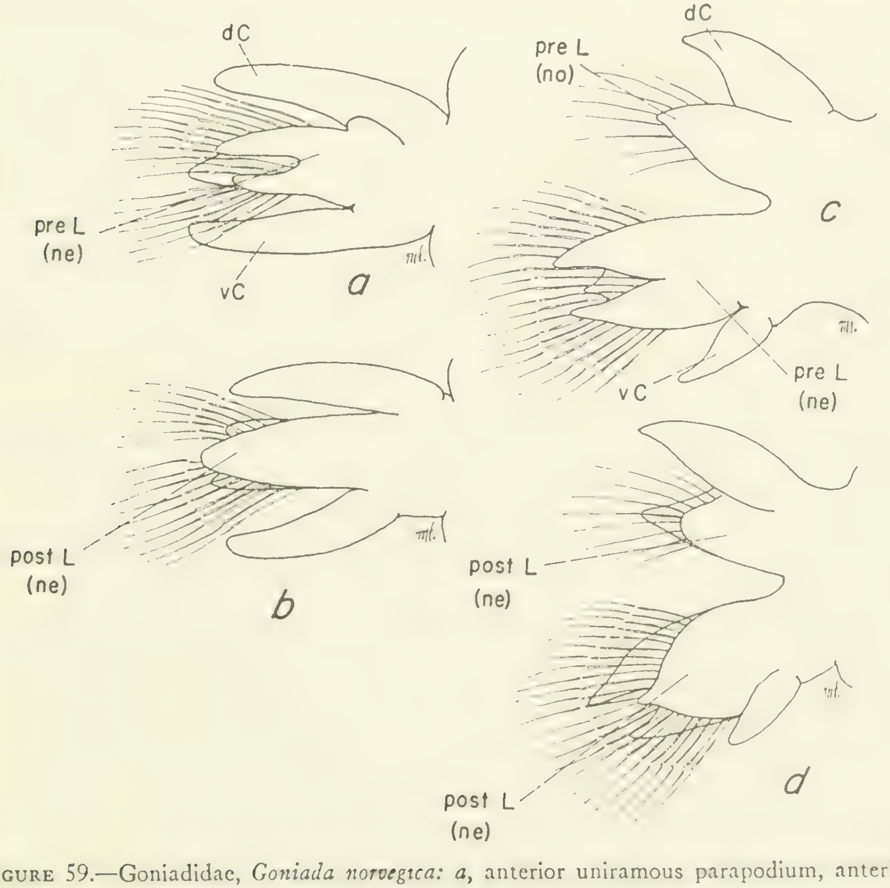

FIGURE 59.—Goniadidae, *Goniada norvegica*: *a*, anterior uniramous parapodium, anterior view; *b*, same, posterior view; *c*, posterior biramous parapodium, anterior view; *d*, same, posterior view.

postsetal lobe wide, rounded with mucronate tip, with presetal lobe bilobed with subequal conical lips. Proboscis with about 17 chevrons in each group (15–21). Distal part with 2 dentate macrognaths each with 3–6 teeth and X-shaped micrognaths forming a complete circlet.

Biology.—Dredged on bottoms of soft sticky mud, very fine sand, muddy sand with rocks, gravel, and shells. Found in the stomach of haddock (Georges Bank, 1954, R. Wigley).

Material examined.—Massachusetts (Georges Bank, 100–175 fathoms, R. Wigley; U.S. Fish Commission Location 876, 39°57′ N., 70°56′ W., 120 fathoms, 1880; Location 1028, 39°57′ N., 69°17′ W., 410 fathoms, 1881).

Distribution.—Norway, Faroes, Iceland to North Sea, Mediterranean, Adriatic, West Africa; off Massachusetts to off Long Island Sound, West Indies. In 22 to 466 fathoms.

Goniada brunnea Treadwell, 1906

Figure 57,*a,b*

Goniada brunnea Berkeley and Berkeley, 1948, p. 33, fig. 44.—Hartman, 1950, p. 17, pl. 1, figs. 1–6, pl. 4, fig. 1.—Not Knox, 1960, p. 136.

Description.—Length up to 160 mm., width up to 5 mm., segments up to 200. Anterior uniramous region of about 44 segments (38–50). Dorsal cirri broad, foliaceous, with more slender base. Neuropodium with equally bilobed presetal lobe and entire postsetal lobe. Ventral cirri similar to the neuropodial lobes. Posterior biramous region only slightly enlarged, with parapodial rami well separated (fig. 57,*a,b*). Dorsal cirri broad, foliaceous, with more slender base. Notopodium with presetal lobe longer, conical, and postsetal lobe shorter, rounded. Neuropodium with presetal lobe bilobed with lobes subequal, conical. Postsetal lobe slightly shorter than presetal lobe, conical. Proboscis with about 18 chevrons in each group (9–19). Distal part with 2 dentate macrognaths each with 4–6 teeth. About 10 X-shaped micrognaths in ventral arc; none in dorsal arc.

Biology.—Dredged on bottoms of mud and broken shells. Found at low water.

Material examined.—North Atlantic (*Albatross* III, 40°30′ N., 70°35′ W., 37 fathoms, 1955, R. Wigley; *Albatross* Station 2018 37°12′ N., 74°20′ W., 788 fathoms; Station 2072, 41°53′ N., 65°35′ W., 858 fathoms; Station 2109, 35°14′ N., 74°59′ W., 142 fathoms; Station 2217, 39°47′ N., 69°34′ W., 924 fathoms; Station 2528, 41°47′ N., 65°37′ W., 677 fathoms), North Pacific (Washington and Puget Sounds, 10–140 fathoms).

Distribution.—Alaska to southern California, off Hawaii, off Massachusetts to off North Carolina. Low water to 924 fathoms.

Superfamily Eunicea

Includes the Lumbrineridae, Arabellidae, Lysaretidae, Onuphidae, Eunicidae, and Dorvilleidae, sometimes considered as subfamilies belonging to the family Eunicidae. The euniceids have a characteristic dark chitinous or horny (may be partially calcified) pharyngeal apparatus. The pharynx is capable of protrusion and is provided with a pair of ventral plates, called mandibles, and a more dorsal bilaterally arranged series of chitinous plates, called maxillae. The maxillary pieces consist of several pairs of toothed plates (numbered I to VI, with additional embedded maxillary carriers) or numerous rows of toothed plates (in Dorvilleidae).

The parapodia are essentially uniramous. The notopodia may be represented by rudimentary lobes or only by a few embedded notoacicula in the bases of the dorsal cirri. The setae are of 1 to several kinds, simple or compound or both. Dorsal and ventral cirri and branchiae are present or lacking. Anal cirri are 2–4 in number. The prostomium is bare, without appendages or provided with 1 to 7 antennae and 2 palps, with or without eyes (0, 2, 4). Typically there are 2 apodous and achaetous tentacular segments (single in Onuphidae and some Lysaretidae, due apparently to fusion of the first segment either with the prostomium or second segment), with or without a single pair of dorsal tentacular cirri. The euniceids vary from those of minute size to very large ones—among the largest of the polychaetes.

The families of Eunicea may be separated by the key below (see also the key to the families on p. 10, based on more external characters).

Key to the Families of Eunicea

1. Maxillae consisting of numerous small denticled pieces arranged in longitudinal series (fig. 60*f*). Prostomium (fig. 60*a*) with a pair of elongate lateroventral palps and a pair of articulated dorsolateral antennae (or both pairs short, subequal in *Ophryotrocha*). Two apodous tentacular segments, without tentacular cirri. Dorsal and ventral cirri present, subulate (fig. 60*b*). Without branchiae. Setae simple and compound. Mostly small to minute in size . . . . **Dorvilleidae (p. 230)**

Maxillae consisting of few denticled plates, 3½ to 6 pairs. Mostly larger in size 2

2. Maxillae with a pair of short broad maxillary carriers, or supports, embedded in the pharyngeal tissue, without unpaired piece (fig. 69*j*). With or without branchiae. With hooded hooks (fig. 69*g*) or with compound or pseudocompound setae at least on some anterior setigers 3

Maxillae with a pair of long slender maxillary carriers, or supports, embedded in the pharyngeal tissue and usually also an unpaired median piece (fig. 72*h*; maxillary carriers may be rather short in some Lysaretidae). Without branchiae. Without ventral cirri. Setae all simple, without compound setae or hooded hooks. Prostomium conical or rounded, without distinct palps. Without tentacular cirri 5

3. Maxillae 4 pairs (fig. 69*j*). Prostomium (fig. 69, *a,b*) without antennae (may be 3 minute ones), without distinct palps (with pair of ventral buccal cushions which may represent poorly developed palps). Two apodous tentacular segments, without tentacular cirri. Without dorsal or ventral cirri (fig. 69,*c,d*) . . . . **Lumbrineridae** (p. 256)

Maxillae 3½ to 5½ pairs (right maxilla III missing; fig. 64*f*). Prostomium with 1 to 5 dorsal occipital antennae, 2 globular ventral palps (fig. 64,*a,b*). With or without single pair tentacular cirri. With dorsal and ventral cirri (ventral cirri may be short, globular in middle and posterior segments) . 4

4. Prostomium with 2 frontal antennae and 5 dorsal occipital antennae, the latter with more or less conspicuous ringed bases or ceratophores (fig. 64,*a,b*). Single apparent tentacular or buccal segment (first segment perhaps fused with prostomium) . . . . **Onuphidae** (p. 243)

Prostomium without frontal antennae, with dorsal occipital antennae (1, 3, or 5), without ringed ceratophores (fig. 62*a*). Two apodous tentacular segments . . . . **Eunicidae** (p. 234)

5. Dorsal cirri rudimentary or lacking. Two apodous tentacular segments. Prostomium without antennae (fig. 71*a*) . . . . . . **Arabellidae** (p. 268)

Dorsal cirri large, flat foliaceous. Tentacular segments 1–2. Prostomium with 3 short to minute antennae at posterior margin (may be hidden by tentacular segment) . . . . **Lysaretidae** (not represented)

Family Dorvilleidae (=Staurocephalidae and Stauronereidae)

Representatives are usually small to minute in size, composed of a moderate number of segments, slender, cylindrical, or fusiform. Prostomium suboval to subpentagonal, with a pair of dorsal more or less articulated antennae and a pair of lateroventral palps, usually rather long (fig. 60*a*) or both simple, minute and subequal (in *Ophryotrocha*), with or without eyes (0, 2, or 4). First 2 tentacular segments apodous, without tentacular cirri. With short subulate dorsal and ventral cirri. Anal cirri 2, 3, or 4. Without branchiae. Parapodia essentially uniramous. Notopodium may be represented by acicula within the cirrophores of the dorsal cirri (fig. 60*b*). Neuropodia with upper group of simple setae and lower group of compound setae. Portions of the body may be ciliated, as segmental transverse bands along bases of parapodia and cirrophores of dorsal cirri.

Proboscis eversible, with a pair of dark ventral mandibles (fig. 60*e*) and numerous small, paired maxillary plates arranged in longitudinal series (fig. 60*f*). The dark jaws may be seen through the body wall in living specimens.

The dorvilleids are small, wandering, carnivorous, occurring mostly between the tide marks or in shallow water. They secrete abundant mucus and burrow in sand and form temporary tubes beneath the stones (Moore, MS.). Sexual maturity is attained without metamorphosis so far as is known.

Contains only one New England genus.

Genus *Stauronereis* Verrill, 1900

Type (original designation): *Stauronereis rudolphi* (Delle Chiaje, 1828).

Both species represented have the prostomium bluntly conical, rounded anteriorly, with a pair of long lateroventral palps curved posteriorly, transversely wrinkled and with a distinct distal ovoid article, with a pair of articulated laterodorsal antennae (fig. 60*a*). First 2 tentacular segments apodous, the first slightly longer than the following; ventrally first segment with large mouth, anterior to which are 2 prominent oval lateral lips. Dorsal cirri lacking on first setiger; rest with long cylindrical cirrophores supported internally by fine acicula, distally with subulate cirrostyles (fig. 60*b*). Ventral cirri subulate, inserted ventrally near parapodial tips. Parapodia long, cylindrical, with a somewhat bilobed presetal lobe and conical postsetal lobe, evidently mobile and quite variable in shape.

Upper bundle of setae of 2 kinds: (1) Long, slender, ending in delicate capillary tips, finely denticled along one edge; (2) shorter forked setae with branches unequal, denticled at base of shorter branch (figs. 60*c*, 61*d*). Lower group of setae heterogomph compound falcigers with distal blades short to long, with tips bidentate (fig. 60*d*). Proboscis with a pair of dark ventral mandibles, usually showing through the translucent integument, flared and denticled on anterior border (fig. 60*e*).

Key to the New England Species of *Stauronereis*

1. Prostomium with 4 eyes (fig. 60*a*). Forked setae with 2 unequal stout branches (fig. 60*c*) . . . . **S. rudolphi**
   Prostomium without eyes (fig. 61*a*). Forked setae with 2 very unequal slender branches (fig. 61*d*). . . . . **S. caecus**

Stauronereis rudolphi (Delle Chiaje, 1828)

FIGURE 60

Staurocephalus pallidus Verrill and Smith, 1874, p. 301.—Webster, 1879, p. 242; 1886, p. 145.—Webster and Benedict, 1884, p. 721.

Stauronereis annulatus Moore, 1906a, p. 225, pl. 10, figs. 12–13, pl. 11, figs. 18–22.

Staurocephalus rudolphii Fauvel, 1923, p. 446, fig. 178.—Monro, 1933b, p. 92.—Wesenberg-Lund, 1950a, p. 29, pl. 7, fig. 30.

Stauronereis articulatus Hartman, 1938b, p. 101, figs. 39–44.—Rioja, 1941, p. 724, pl. 6, figs. 10–18.

Dorvillea rudolphii Hartman, 1942*b*, p. 56, figs. 98–103; 1944a, p. 340, pl. 17, figs. 10–11, pl. 23, fig. 6; 1944d, p. 191; 1945, p. 27, pl. 5, figs. 2, 6; 1951, p. 66, pl. 8, fig. 6.—Berkeley and Berkeley, 1948, p. 86, figs. 127–129.—Wesenberg-Lund, 1962, p. 118.

Dorvillea articulata Hartman, 1944d, p. 189; 1960b, p. 106.—Rioja, 1947a, p. 205.—Reish, 1959, p. 84.

Dorvillea annulata Berkeley and Berkeley, 1948, p. 87, fig. 130.

DESCRIPTION.—Length up to 50 mm., width up to 3 mm., segments up to 80 (when living, sometimes 70 mm. long and 0.7 mm. wide, very

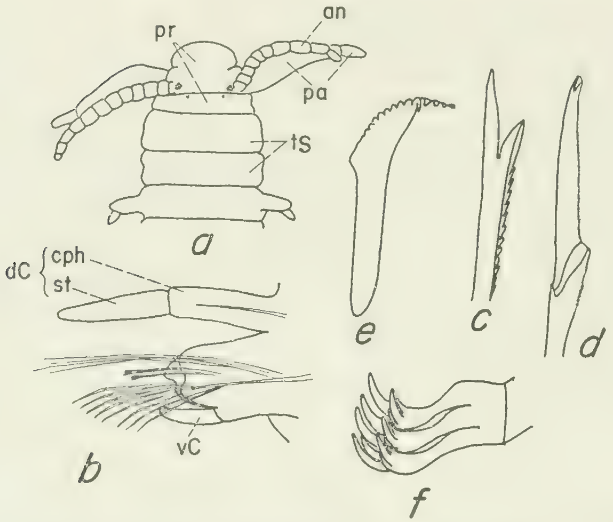

FIGURE 60.—Dorvilleidae, *Stauronereis rudolphi* (after Moore, MS.): *a*, dorsal view anterior end; *b*, parapodium from middle region (setiger 33), anterior view; *c*, forked seta from upper group neurosetae; *d*, compound seta from lower group neurosetae (compound heterogomph falciger); *e*, left mandible; *f*, several maxillary teeth.

contractile, shrinking to 23 mm. in alcohol, Moore, MS.). Body slender, linear, widest in middle, tapered toward both ends, flattened ventrally, arched dorsally. Prostomium (fig. 60*a*) somewhat annulated, divided into 2–3 more or less complete rings. Antennae with 5–12 articles. Anterior pair of eyes larger, situated between the bases of the antennae and palps; posterior pair of eyes small, situated dorsally at the bases of the antennae (may be lacking). Anal segment with 2 pairs anal cirri, dorsal pair longer, articulated.

Maxillae of proboscis with 3 pairs larger plates more posteriorly, radiating into 2 pairs of longitudinal rows of denticled plates, the inner rows lighter, thornlike, with more numerous denticles, the outer row heavier, V-shaped, with few denticles (fig. 60*f*; sometimes with a third outer row of lighter curved denticled hooked plates). Color: flesh, pale yellow or orange, with yellowish brown or red eyes, red blood showing in long dorsal cirrophores of the dorsal cirri, the black jaws showing through; at maturity, males pinkish, females grey violet.

Stauronereis annulata Moore is herein referred to *S. rudolphi*. It is characterized by having some compound setae with very long blades; this appears to be a variable character, perhaps associated with the semipelagic character of the species. The extra long setae may occur in small specimens or mature specimens. In a group of 13 specimens from Meadowdale, Washington, there were gradations of the blades, the longest being 2 to 5 times longer than the shortest; also the upper long simple setae varied in number from 3 to 14 or so.

Biology.—Found at low water in sand or sandy mud, under stones. Dredged on bottoms of sandy clay, in sand and shells, in "weed" (Lagoon Pond, Martha's Vineyard). They are filled with ripe eggs in July in the Woods Hole area (Moore, ms.). Small specimens may be found at the surface at the light (Fisheries Dock, Woods Hole, July 26, 1954). They may be somewhat pelagic in habit.

Material examined.—Type specimens of *Stauronereis annulata* Moore from Washington and *S. articulatus* Hartman from California. Also Massachusetts (Woods Hole region, Stony Beach, North Falmouth; Lackeys Bay on Nonamesset Island, Lagoon Pond on Martha's Vineyard; Vineyard Sound, surface), Rhode Island (Newport), North Carolina (Beaufort), Florida (Seahorse Key), Washington (San Juan Island near Turn Island, Edmonds, Meadowdale).

Distribution.—Off Norway, English Channel, Mediterranean, Massachusetts (Cape Cod) to Florida, Gulf of Mexico, West Indies, British Columbia to Lower California, Mexico, Chili. Low water to 144 fathoms; young and mature forms at surface.

Stauronereis caecus (Webster and Benedict, 1884)

Figure 61

Staurocephalus caecus Webster and Benedict, 1884, p. 721, pl. 4, figs. 44–48.—Uschakov, 1955, p. 246, fig. 83.

Description.—Length up to 8 mm., width up to 0.6 mm., segments up to 60. Body long, slender, nearly cylindrical, tapered slightly anteriorly and posteriorly, flattened ventrally, arched dorsally. Prostomial antennae with 10–15 articles (fig. 61*a*). Anal segment with 3 anal cirri, lateral-ventral pair longer and annulated, median-ventral one shorter (fig. 61*b*). Maxillae of proboscis with a more posterior basal fused piece, diverging into a pair of longitudinal rows of comb plates each with one larger tooth, each row diverging into a double row of curved denticled plates. Color: white.

The young have been described thus by Webster and Benedict. Antennae and palps appear as mere buds. Dorsal and ventral cirri both short, globular, the long dorsal cirrophores of the dorsal cirri lacking. Good portion of body ciliated, moving by a uniform gliding motion. In more advanced stages, palps more elongate, antennae short and clubbed.

Biology.—Found at low water in sand. Dredged on bottoms of sticky mud, sandy mud, silty clay and fine sand, with tubes, shells, and among tunicates (as sandy *Amaroecium*).

Material examined.—Gulf of St. Lawrence (Bay of Chaleurs, Gaspé Bay, 7–85 fathoms), Maine (Ebenecook Harbor, Southport Island, Boothbay Harbor region, 3 fathoms), Massachusetts (*Albatross* III, 40°46′ N., 67°32′ W., 44 fathoms; 41°20′ N., 68°35′ W.,

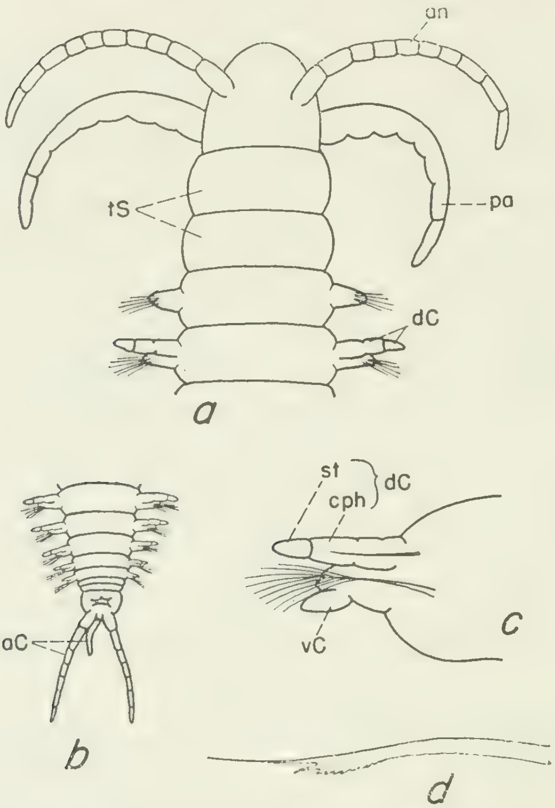

Figure 61.—Dorvilleidae, *Stauronereis caecus: a*, dorsal view anterior end; *b*, dorsal view posterior end; *c*, middle parapodium; *d*, forked seta from upper group neurosetae (after Webster and Benedict, 1884).

37 fathoms, 1957, R. Wigley; Stony Beach, Woods Hole; Vineyard Sound and Cape Cod Bay, 10–20 fathoms; Buzzards Bay, 10 fathoms, H. Sanders).

Distribution.—Gulf of St. Lawrence to Massachusetts, north Japan Sea. Low water to 85 fathoms.

Family Eunicidae (=Leodicidae)

Body elongate, cylindrical, somewhat flattened and tapered posteriorly. Prostomium (fig. 62*a*) short, thick; with 1, 3, or 5 occipital antennae without distinct ceratophores; without frontal antennae; with stout, globular palps fused to the prostomium and indicated by a deep median groove ventrally; with usually 2 eyes (rarely 4). First 2 tentacular segments apodous and achaetous, with or without a pair of tentacular cirri inserted dorsally on the second one (fig. 63*e*). Parapodia essentially uniramous. Notopodia may be represented by a few acicula in the bases of the dorsal cirri. Neuropodia with setae of several kinds, simple setae with fine tips (fig. 62*e*), compound setae (fig. 62*f*), usually short delicate comb setae (fig. 62,*g*,*h*), with or without a lower stout acicular seta (fig. 62*i*). With dorsal and ventral cirri, some of the latter often inflated, padlike. With 2 to 4 anal cirri. With or without branchiae. When present, branchiae appended to medial side of dorsal cirri, simple or pectinate (fig. 62*d*).

Proboscis with a pair of stout ventral wing-shaped mandibles, the anterior border forming a beveled cutting edge (fig. 62*j*). Maxillae with a pair of short maxillary carriers, with 3½ to 5½ pairs of maxillary plates (1 more jaw plate on the left than on the right side; right maxillae III missing). The basal pair, maxillae I, in the form of large hooks or forceps; the rest of the maxillae toothed along the inner margins (fig. 62*k*).

The family is particularly well represented in warmer tropical waters; many species are associated with corals. Some of the eunicids become remarkably large in size. They are active and predaceous, feeding on vegetable as well as animal matter. Most species form more or less permanent tubes. In some species, fissiparity occurs at sexual maturity, the posterior genital segments becoming detached and swarm at the surface, as for example the famous "Palolo." They possess great capacity of regeneration of both the anterior and posterior ends.

Both genera represented have 5 occipital antennae (figs. 62*a*; 63,*a*,*e*; may be 3 antennae in young), with parapodial branchiae emerging above the bases of the dorsal cirri (figs. 62*d*; 63*b*).

Key to the New England Genera of Eunicidae

1. Without tentacular cirri (fig. 62*a*) . . . . **Marphysa**
With a pair of short tentacular cirri on the second tentacular segment (fig. 63*e*) . . . . **Eunice**

Genus *Marphysa* Quatrefages, 1865

Type (designated by Hartman, 1944*d*): *Marphysa sanguinea* (Montagu, 1815).

Both species represented have the prostomium with 5 occipital antennae nearly equal, slightly longer than the prostomium, smooth or feebly fluted; with 2 eyes between the bases of the paired occipital antennae (figs. 62*a*, 63*a*). Two tentacular segments without tentacular cirri, the first about twice as long as the second. Posterior end with 4 anal cirri ventrally on the anal ring, the most ventral pair very short, the other pair longer, filiform (fig. 62*c*). Anterior parapodia with a digitiform postsetal lobe, gradually becoming shorter, conical.

Parapodia with setae of several kinds: Upper bundle with (1) long, slender setae tapering to capillary tips (fig. 62*e*) and (2) short, delicate, pectinate or comb setae (fig. 62,*g–h;* few in number, easily missed); lower bundle with (3) compound setae (figs. 62*f*, 63*d*) and (4) single lower acicular seta beginning on about setigers 35–45 (fig. 62*i*). Acicula dark to black. Proboscis with a pair of elongated dark mandibles, flaring anteriorly (fig. 62*j*). Maxillae, I forcepslike, with a pair of short elongate-ovate maxillary carriers; maxillae V represented by a pair of small squarish chitinous plates (fig. 62*k*).

Key to the New England Species of *Marphysa*

1. Prostomium and fused palps distinctly notched anteriorly (fig. 62*a*). Branchiae begin on about setiger 20 (10–40), extending over a long region of body, with 1 to 8 filaments per branchia (fig. 62,*b*,*d*) . . . **M. sanguinea**

   Prostomium and fused palps rounded anteriorly, not notched (fig. 63*a*). Branchiae begin on setigers 12–15, relatively few in number (12–21 pairs), with 7–19 filaments per branchia (fig. 63*b*) . . . . **M. bellii**

Marphysa sanguinea (Montagu, 1815)

Figure 62

Marphysa leidyi Verrill and Smith, 1874, pp. 25, 38, 53, 70, 116, 128, 140, 299, pl. 12, fig. 64.—Verrill, 1881, pp. 291, 301, pl. 4, fig. 3.—Sumner, Osburn, and Cole, 1913, p. 621.

Marphysa sanguinea Webster, 1879, p. 236, pl. 6, figs. 76–80, pl. 7, figs. 81–83; 1886, p. 144.—Andrews, 1891a, p. 287.—Fauvel, 1923, p. 408, fig. 161,*a–h;* 1933, p. 28; 1953, p. 245, fig. 123,*a–h*.—Hartman, 1944a, p. 127, pl. 17, fig. 16 (as *Eunice floridana*); 1944d, p. 127, pl. 8, figs. 179–183; 1945, p. 23; 1951, p. 57, pl. 14, figs. 3–6; 1956, pp. 254, 262, 268, 284.—Andrew and Andrew, 1953, p. 9.—Fauvel and Rullier, 1957, p. 87; 1959, p. 946.—Wesenberg-Lund, 1958, p. 17.—Rioja, 1958, p. 264.—Reish, 1959, p. 83.—Clark, 1960, p. 22.—Day, 1960, p. 335.

Marphysa acicularum Webster, 1884, p. 319, pl. 10, figs. 50–53.

Marphysa orientalis Treadwell, 1936, p. 266, fig. 18,*i–o*.

Description.—Length up to 600 mm., width up to 11 mm., segments up to 500. Anterior few segments of body narrower, cylindrical, then becoming wider, greatly flattened, tapering gradually posteriorly; it breaks up very easily. Branchiae begin on about setiger 20 (10–40) as a single or double filament above the bases of the dorsal cirri, with a maximum of usually 4 filaments (2–8), with a palmate-pectinate arrangement (fig. 62*d*), continuing as a simple filament to near the posterior end. Dorsal cirri short, digitiform, scarcely longer than the parapodium. Ventral cirri digitiform on anterior region, becoming shorter, thicker with rounded knoblike tips laterally.

Parapodia with lower bundle of compound setae all heterogomph spinigerous, distally pointed, with long and short blades (fig. 62*f*). Single lower heavy acicular seta beginning on about setiger 45, light amber colored or transparent, bifid and hooded distally (fig. 62*i*);

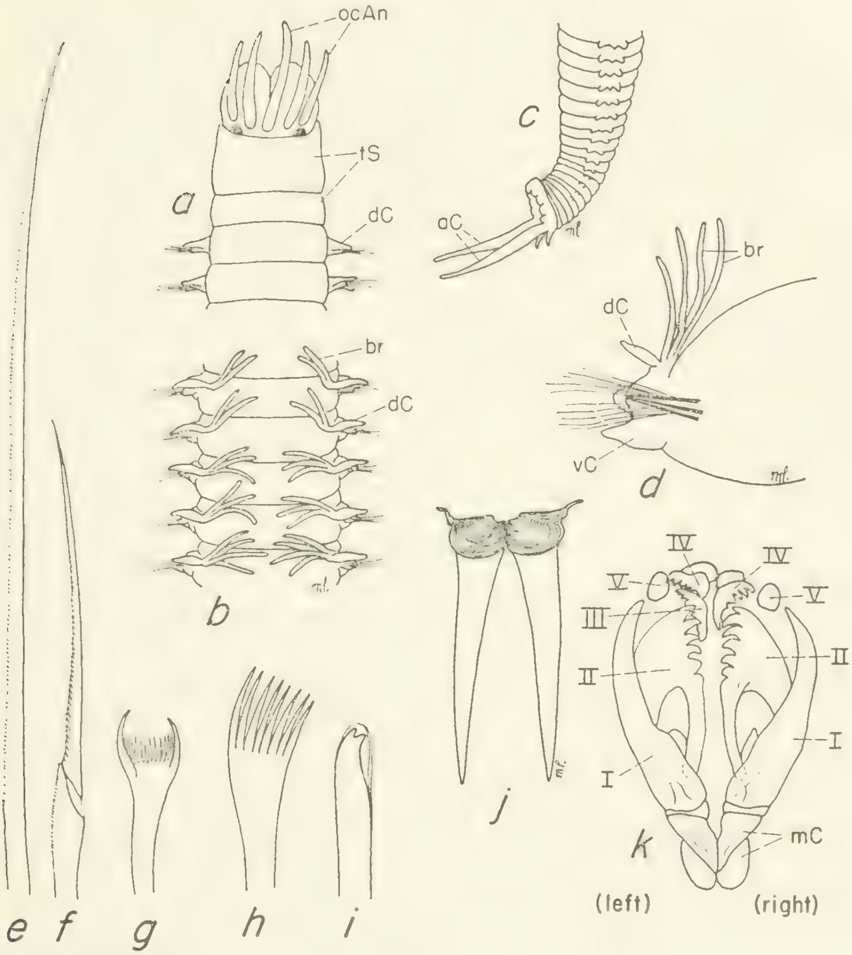

FIGURE 62.—Eunicidae, *Marphysa sanguinea* (*e–i*, *k*, after Moore, MS.): *a*, dorsal view anterior end; *b*, dorsal view setigerous segments 25 to 29; *c*, lateral view posterior end; *d*, parapodium from middle region of body, anterior view; *e*, simple capillary seta from setiger 8; *f*, shorter bladed compound spinigerous seta from setiger 8; *g*, simple comb seta from setiger 8; *h*, same, from setiger 48; *i*, hooded acicular seta or crotchet from setiger 48; *j*, mandibles; *k*, maxillae, dorsal view.

2–3 black acicula per parapodium. Maxillae of proboscis dark brown, heavy. Bases of maxillae I, the forceps, each with 2 longitudinal interlocking ridges; maxillae II with 3–6 teeth; left maxilla III with 5–8 teeth, right maxilla III missing; left maxilla IV with 3–6 teeth; right maxilla IV with 6–10 teeth. Color: yellowish orange, brownish red, pinkish grey, with brilliant opalescent iridescence, branchiae bright red, acicula black.

BIOLOGY.—Found at low water in mud, muddy sand, stiff clay, under rocks or stones, in crevices of rocks, under boards, on wooden pilings, in roots of *Zostera*, in oyster beds, in sponges, in old worm tubes (as *Sabellaria*). It is dredged on various bottoms: fine sand, rocky, gravelly-shelly, with bryozoan nodules. They may have a well defined burrow but no definite tube and may form long galleries in the cracks and fissures of rocks, the tunnels lined with mucus, mud, muddy sand, and gravel. They may leave their burrows in search of other worms and weaker animals upon which they feed; they struggle violently when captured and readily break up; many of the specimens taken have lost and are regenerating the posterior end (Moore, MS.). They are used as bait by fishermen in England, being referred to as "rock-worms" (McIntosh, 1910).

The eggs are laid in July and probably also in June in the Woods Hole region; they are laid in masses of firm jelly (Moore, MS.). Young stages are encountered in June in North Carolina (Hartman, 1945). The young stages have been observed by Webster (1879). The prostomium varies from rounded with no anterior indentation, to slight depression, to distinct indentation. The number of eyespots vary from 5, 4, to 2. The number of antennae varies from 0, 1, 3, to 5. Branchiae vary from none, simple ones, to bifurcated ones. Some have bidentate compound setae which gradually disappear as development proceeds.

MATERIAL EXAMINED.—Numerous specimens from Massachusetts (*Albatross* III, 40°50′ N., 66°58′ W., 50 fathoms, 1953, R. Wigley; New Bedford, Woods Hole region, Cape Cod, Vineyard Sound, Buzzards Bay), Rhode Island, Virginia (Chincoteague Bay area), North Carolina (Beaufort), South Carolina (Jerico Creek, Mackays Creek near Cherchersee River), Florida (Seahorse Key, Key West).

DISTRIBUTION.—A cosmopolitan species. English Channel, France, Mediterranean, Adriatic, Massachusetts (Cape Cod) to Florida, Gulf of Mexico, Bermuda, Bahamas, West Indies, Japan, China, southern California to Mexico, Panama, Indian Ocean, Red Sea, Australia, New Caledonia, East, West and South Africa. Low water to 50 fathoms.

Marphysa bellii **(Audouin and Milne-Edwards, 1833a)**

FIGURE 63,*a–d*

Marphysa bellii Ehlers, 1887, p. 95, pl. 28, figs. 1–8.—Fauvel, 1923, p. 410, fig. 161, *i–q*.—Wesenberg-Lund, 1949, p. 305.—Fauvel and Rullier, 1957, p. 88.

DESCRIPTION.—Length up to 200 mm., width up to 3 mm., segments up to 300. Body long, slender, tapering gradually to long slender posterior end. Branchiae begin on about setiger 12 (12–15), about 15 pairs (12–21), with about 11 (7–19) filaments per branchia, pectinately arranged above the dorsal cirri (fig. 63*b*). Dorsal cirri short, subulate in anterior region (fig. 63*b*), becoming long, filiform, about as long as the setae (fig. 63*c*). Ventral cirri short, digitiform anteriorly, becoming thicker, short, conical.

Parapodia with lower bundle of compound setae both heterogomph spinigerous, distally pointed and heterogomph falcigerous with tips bidentate and hooded (fig. 63*d*). Single lower heavy acicular setae beginning on about setiger 35, prominent, dark, bidentate and hooded distally (fig. 63*c*). Single dark aciculum in each parapodium and which may project distally in more posterior parapodia.

Maxillae of proboscis rather weak, light brown in color; maxillae II with 5–8 teeth; left maxilla III with 7–8 teeth, right maxilla III missing; left maxilla IV with 3–6 teeth, right maxilla IV with 8–9 teeth. Color: pinkish grey or slate colored with bright red branchiae, acicula black.

BIOLOGY.—Found at low water on muddy sand, under stones, in roots of *Zostera*. Dredged on bottoms of sand, gravel, and stones.

MATERIAL EXAMINED.—Massachusetts (*Albatross* III, 42°, 01′ N., 67°27′ W., 25 fathoms, 1957, R. Wigley; Woods Hole region), Rhode Island (off Newport, 13 fathoms).

DISTRIBUTION.—Ireland, English Channel, France, Mediterranean, Adriatic, West Africa, Indochina, off Massachusetts, Rhode Island, Florida, West Indies. Low water to 63 fathoms.

Genus *Eunice* Cuvier, 1817

Leodice (Savigny, MS.) Lamarck, 1818; type (herein designated): *Leodice gigantea* (Savigny, MS.) Lamarck, 1818;=*Eunice aphroditois* (Pallas, 1788).

Type (designated by Hartman, 1959a): *Eunice aphroditois* (Pallas, 1788).

Both species represented have the body elongated, thickened and rounded anteriorly, somewhat depressed and tapered in middle and posterior regions. Prostomium (fig. 63*e*) and fused palps bilobed anteriorly, with 5 occipital antennae, the middle one longest, the most lateral pair shortest, with 2 eyes between the bases of the paired lateral occipital antennae (may be hidden by the tentacular segment). The second tentacular segment about the same length as the following, with a pair of short tentacular cirri extending to the base of the prostomium.

Parapodia with setal lobes rounded to conical, with setae of several kinds: Upper group with (1) long slender, slightly limbate setae with capillary tips and (2) shorter delicate comb setae; lower group of setae (3) compound falcigerous, with blades rather short, bidentate and hooded; beginning on about setiger 40, (4) with a stout acicular seta with tips bidentate and hooded (unless worn). Dorsal cirri digitiform. Ventral cirri short, digitiform on first few setigers, becoming thick basally with short bulbous tips, then becoming digitiform again in far posterior region. Anal end with usually 4 anal cirri, 2 slightly more dorsal ones longer, 2 ventral ones small. Proboscis with a pair of winglike mandibles, with anterior part flared, calcareous and more or less toothed. Maxillae with a pair of short bilobed maxillary carriers; maxillae I, the forceps, in the form of prominent hooks, with 1–2 longitudinal interlocking teeth at the base.

Key to the New England Species of *Eunice*

1. Acicula and acicular setae yellow. Branchiae begin on about setiger 3 (3–5), continuing to about setiger 40; middle and posterior regions without branchiae; where best developed, branchiae extend beyond the dorsal cirri, with 8–22 filaments per branchia . . . . **E. pennata**

Acicula and acicular setae black. Branchiae begin on about setiger 8 (7–10), continuing to near posterior end; where best developed, branchiae about as long as the dorsal cirri, with 3–12 filaments per branchia (fig. 63*f*). **E. norvegica**

Eunice norvegica (Linné, 1767)

FIGURE 63*f*

Leodice polybranchia Verrill, 1880, p. 358; 1885a, p. 524, pl. 41, fig. 180; 1885b, p. 428.

Eunice floridana Ehlers, 1887, p. 88, pl. 22, figs. 1–7.—Fauvel, 1923, p. 402, fig. 157,*a–g;* 1953, p. 235, fig. 117,*a′–g′*.—Hartman, 1942b, p. 49, figs. 85–87; 1944a, p. 339, pl. 14, fig. 7 (not pl. 17, fig. 16=*Marphysa sanguinea*); 1951, p. 56.—Wesenberg-Lund, 1950a, p. 26; 1951, p. 53.—Renaud, 1956, p. 23.—Fauvel and Rullier, 1959, p. 937.—Day, 1960, p. 334.

Eunice norvegica Støp-Bowitz, 1948a, p. 64.

DESCRIPTION.—Length up to 200 mm., width up to 12 mm., segments numerous. Prostomium with occipital antennae nearly smooth or with irregular rings or fluted distally. First tentacular segment 3 to 4 times longer than the following. Branchiae begin on about setiger 8 (7–10), continuing to near the end of the body. Branchiae about as long as the dorsal cirri, pectinately branched, with usually 6–8 filaments (3–12) per branchia. Parapodia with acicula and subacicular hooks black.

Maxillae of proboscis black; maxillae II each with 5–7 teeth; right maxilla III with 7–10 teeth; left maxilla III missing; maxillae IV with 4–7 (right) and 7–10 (left) teeth; maxillae V and VI each with a single tooth. Color: pinkish, brownish or black, spotted with brown; sometimes a pale collar on setiger 4 (Fauvel). Tube: papyraceous, parchmentlike, cylindrical, irregularly bent, rough, with side openings at the angles, often branched. The tubes may be more or less covered with attached hydroids, sponges, anemones, ascidians, etc. A young specimen of 37 setigers had the branchiae on setigers 9–19, consisting of a single filament; subacicular hooks began on setiger 15; antennae distinctly articulated.

BIOLOGY.—Dredged on bottoms of sand, mud, and various combinations of mud, sand, gravel, broken shells, and dead corals. They may

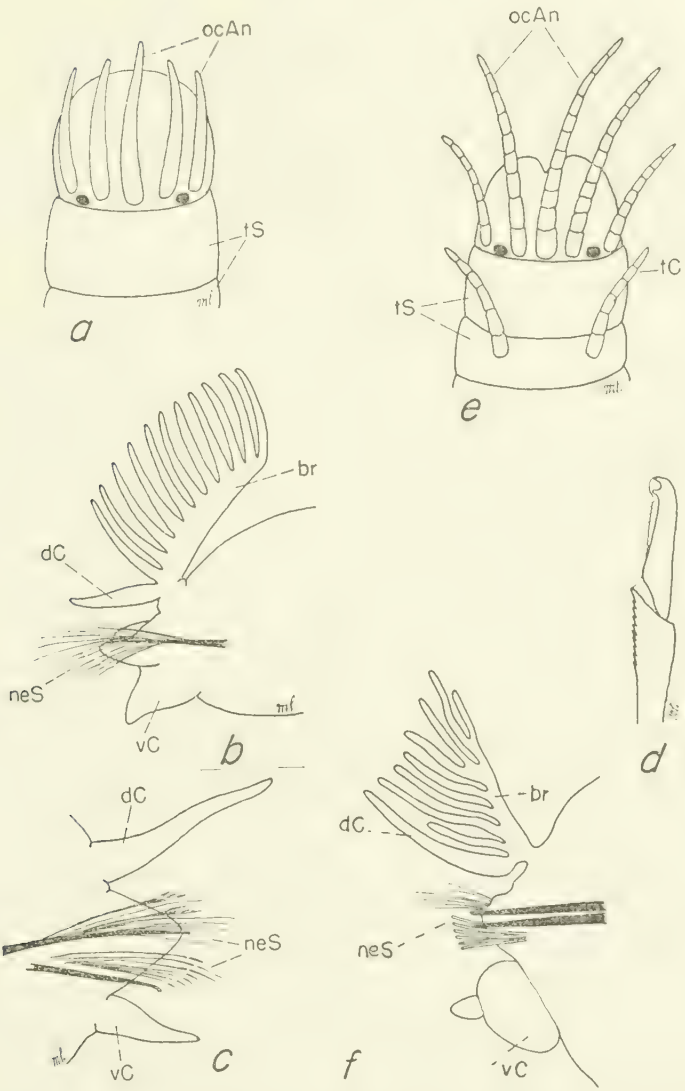

FIGURE 63.—Eunicidae, *a–d*, *Marphysa bellii: a*, dorsal view anterior end; *b*, parapodium from setiger 20, posterior view; *c*, posterior parapodium; *d*, compound falcigerous seta from lower bundle. *e*, *Eunice pennata*, dorsal view anterior end. *f*, *Eunice norvegica*, parapodium with well-developed branchia (after Ehlers, 1887).

be associated with corals (as *Lophohelia*); they live in parchmentlike sinuous tubes which may be entirely surrounded by the coral so that the worm might creep through the genuine tunnels of the corals (Wesenberg-Lund, 1951). They may be found in the umbilical chamber of living gastropod *Turgurium longleyi* Bartsch (Hartman, 1951). A small specimen was found at the surface (Woods Hole region, October 1882).

MATERIAL EXAMINED.—Numerous specimens from off Martha's Vineyard, Massachusetts (40°34′ N., 69°50′ W.) to west of Puerto Rico (18°17′ N., 67°24′ W.), 32 to 600 fathoms.

DISTRIBUTION.—Iceland, Norway, off Shetlands, Denmark Strait to France, Azores, Mediterranean, off Massachusetts to off Florida, West Indies, Gulf of Mexico, Indian Ocean, West and South Africa. In 1 to 832 fathoms.

Eunice pennata (O. F. Müller, 1776)

FIGURE 63*e*

Leodice vivida Verrill, *in* Smith, Harger, and Verrill, 1874, pp. 11, 16, 20, 41, pl. 5, fig. 5.—Verrill, 1881, pp. 290, 297, 304, 308, 311; 1885a, p. 524.

Leodice benedicti Verrill, 1885b, p. 427.

Eunice pennata Fauvel, 1923, p. 400, fig. 156,*h–o;* 1957b, p. 214.—Wesenberg-Lund, 1950a, p. 25; 1950b, p. 66; 1951, p. 52.—Clark, 1960, p. 22.—Day, 1960, p. 334.—Eliason, 1962, p. 253.

Eunice benedicti Hartman, 1942b, p. 52, figs. 88–90; 1944a, p. 339, pl. 23, fig. 5.

Eunice vivida Hartman, 1944a, p. 339, pl. 17, fig. 18.

Eunice norvegica Hartman, 1956, pp. 252, 268, 283.—Not Linné, 1767.

DESCRIPTION.—Length up to 150 mm., width up to 8 mm., segments numerous. Prostomium with occipital antennae distinctly annulated, at least near tips (fig. 63*e*). First tentacular segment 2 to 3 times longer than the following. Branchiae begin usually on setiger 3 (3–5), continuing to about setiger 40 (30–46), leaving the middle and posterior parts of the body without branchiae. Branchiae where best developed extend beyond the dorsal cirri, pectinately branched, with usually up to 16 (8–22) filaments per branchia. Parapodial acicula and acicular setae yellow.

Maxillae of proboscis light brown, with teeth and borders darker; maxillae II each with 6–10 teeth; right maxilla III with 8–12 teeth; left maxilla III missing; maxilla IV with 3–8 (right) and 8–11 (left) teeth; maxillae V small squarish plates; maxillae VI missing. Color, in alcohol: more or less uniformly yellowish brown. Tube: cylindrical, irregular, thin, with parchmentlike base and rather sparse and irregularly arranged foreign materials, as pebbles, rocks, shell fragments, foraminiferans, and debris. Young specimen of about 34 setigers had the prostomium rounded or only slightly indented; branchiae began on setiger 3, up to 3–6 filaments per branchia.

BIOLOGY.—Dredged on bottoms of mud, sand, globigerina ooze, pebbles, rocks, gravel, and various combinations of sand, mud, clay, gravel, stones, pebbles, broken shells, and coral. They may be associated with corals, along with *Eunice norvegica*. Their parchmentlike tubes are most frequently attached to stones and empty shells.

Material examined.—Very numerous specimens from off Newfoundland (44°26′ N., 62°10′ W.) to off Florida (27°04′ N., 83°21′ W.), in 2 to 1,582 fathoms.

Distribution.—Greenland, Spitsbergen, Iceland, Norway to France, Mediterranean, Adriatic, Davis Strait, off Newfoundland to off Florida. In 2 to 1,800 fathoms.

Family Onuphidae

The onuphids are modified for a tubicolous mode of life. Body elongate, vermiform, with numerous similar segments, with smooth, polished iridescent cuticle. Prostomium (fig. 64,*a*,*b*) with 2 globular ventral palps. Seven antennae present, 2 frontal, 5 occipital with more or less ringed bases or ceratophores. With or without eyes. A single apparent apodous buccal or tentacular segment (probably first segment either fused with prostomium or with second segment), with or without a pair of short dorsolateral tentacular cirri (fig. 64*a*). Branchiae present or absent; when present, they are simple (fig. 64*d*), pectinate (fig. 65*b*), or spiral (fig. 66,*a*,*b*).

Parapodia essentially uniramous. There may be embedded notoacicula in the bases of the dorsal cirri. Anterior feet more or less modified, enlarged and directed anteriorly (or no longer than succeeding). Setae of several kinds. Dorsal cirri cirriform; ventral cirri cirriform anteriorly, rest reduced to flattened, cushionlike glandular pads (fig. 65,*a*,*b*). Pygidium with 2–4 anal cirri (fig. 66*c*). Proboscis with a pair of ventral mandibles (fig. 64*e*) and 4½ pairs of maxillae (right maxilla III missing), with a pair of short broad maxillary carriers (fig. 64*f*). Jaws rather weakly developed compared to the other related families of euniceids. Carnivorous.

The tubes, on the whole, are characteristic of the species, consisting of a thinner or thicker parchmentlike base secreted by the animal (may be translucent), on the outside of which may be attached foreign particles of various sorts, as sand, mud, gravel, shell fragments, fibers or spicules of sponges, and shells of foraminiferans. The tubes may be composed exclusively of the hardened secretion from the animal, as in *Hyalinoecia*. The onuphids live in a permanent tube. The tube may be free and unattached as in *Hyalinoecia* and *Onuphis conchylega*, so that the onuphid may pull out of the tube or drag it along; or the tube may be buried in the substratum with end protruding; in which case the onuphid pulls out of the tube to gather food or foreign materials to be incorporated in the tube.

Key to the New England Genera of Onuphidae

1. First or apodous buccal or tentacular segment with a pair of tentacular cirri (fig. 64*a*) 2
   First segment without tentacular cirri (fig. 65*d*) . . . **Hyalinoecia** (p. 254)
2. Branchiae lacking (subgenus PARADIOPATRA), simple, cirriform (subgenus NOTHRIA, fig. 64*d*), pectinate or pinnately divided (subgenus ONUPHIS, fig. 65*b*), not spiraled . . . . **Onuphis** (p. 244)
   Branchiae strongly spiraled, (fig. 66,*a*,*b*) . . . . **Diopatra** (p. 250)

Genus *Onuphis* Audouin and Milne-Edwards, 1833a

Type (monotypy): *Onuphis eremita* Audouin and Milne-Edwards, 1833a.

Subgenus *Nothria* Malmgren, 1867

Type (monotypy): *Nothria conchylega* (Sars, 1835).

All 4 species represented have the body long, of nearly uniform width, tapered slightly anteriorly and more or less abruptly posteriorly, cylindrical in anterior 5 or so segments, greatly flattened dorsoventrally along rest of body. Prostomium (fig. 64,*a*,*b*) suboval, with a pair of short ovate or subconical frontal antennae, with 5 occipital antennae with more or less ringed ceratophores and tapering styles. The 3 dorsal occipital antennae longer than the 2 lateroventral ones. Ventrally a pair of prominent globular transverse-oval palps present. Apodous buccal or tentacular segment with a pair of cirriform or subulate tentacular cirri and ventrally forming an arched lower lip behind the mouth. Dorsal cirri subulate, cirriform on anterior segments, becoming shorter more posteriorly. Ventral cirri subulate, tapering on first 2 to 6 setigers, becoming thick, globular, cushionlike more posteriorly.

Parapodia with prominent cirriform or subulate postsetal lobes on anterior 6 or so setigers (figs. 64*c*, 65*a*), becoming gradually smaller and forming short conical or stublike lobes after about setiger 15. Anterior few parapodia somewhat enlarged and turned forward and provided with special setae, hooded (unless worn), slightly hooked, usually pseudoarticulate. Rest of parapodia provided with (1) slightly limbate setae, (2) pectinate or comb setae, and (3) beginning on about setigers 9–17, 2 large stout, hooked subacicular setae which are bidentate, hooded (may be worn off).

Proboscis with mandibles in form of a pair of long slender wings, flaring anteriorly, whitish in part, more or less translucent, only a small part brownish (fig. 64*e*). Maxillary jaws delicate, soft, light colored for the most part, with darker lines and darker teeth (fig. 64*f*). Maxillary carriers short, subrectangular or tapered posteriorly; maxillae I, falcate hooks; maxillae II with 6–8 (left) and 8–9 (right) teeth; left maxilla III with 8–10 teeth, right maxilla III missing;

maxillae IV anterior curved plates with 4–9 (left) and 7–11 (right) teeth; maxillae V small chitinous plates, each with a single tooth.

Key to the New England Subgenera and Species of *Onuphis*

1. Branchiae simple, cirriform (subgenus NOTHRIA; fig. 64,*c*,*d*) 2
   Branchiae pectiniform or with 2 or more filaments where best developed (subgenus ONUPHIS, fig. 65*b*) 3
2. Branchiae begin on first setiger (fig. 64*c*). Parapodia of first setiger not greatly enlarged, without heavy acicular hooks. Tube cylindrical, encrusted with fine mud . . . . **O. (Nothria) opalina**
   Branchiae begin on setigers 9–13. Parapodia of first setiger greatly enlarged, extending forward and downward beyond the prostomium, with conspicuous amber-colored hooked setae (fig. 65*a*). Tube free, greatly flattened, with parchmentlike base overlaid with flat rocks, broken shells, etc. **O. (Nothria) conchylega**
3. Branchiae begin on first setiger as a simple filament (fig. 65*c*), with a maximum of 5–7 pectiniform filaments . . . . **O. (Onuphis) eremita**
   Branchiae begin on setigers 5–6 as simple or pectiniform filaments, with maximum of 4–5 filaments (fig. 65*b*) . . . . **O. (Onuphis) quadricuspis**

Onuphis (Nothria) opalina (Verrill, 1873b)

FIGURE 64

Nothria opalina Verrill, 1873b, p. 102; 1874b, p. 381, pl. 4, fig. 4.—Verrill, *in* Smith, Harger, and Verrill, 1874, p. 41, pl. 7, fig. 4.—Hartman, 1944a, p. 340, pl. 17, fig. 19.

Onuphis cf. *holobranchia* McIntosh, 1903, p. 152, pl. 13, figs. 38–39.—Not Marenzeller, 1879.

Onuphis cf. *opalina* Augener, 1906, p. 137, pl. 4, figs. 74, 75.

DESCRIPTION.—Length up to 125 mm., width up to 4 mm., segments numerous. Prostomium (fig. 64,*a*,*b*) without eyes. Ceratophores of occipital antennae long, ringed (8–11 rings). Dorsolateral pair of occipital antennae longer than the median unpaired one. Branchiae (fig. 64,*c*,*d*) simple, long, slender, beginning on first setiger and continuing to near posterior end. Ventral cirri subulate on first 6 setigers. Special hooked setae of anterior 5 setigers tridentate (may be worn). Anal cirri 4, moderately long. Color, in alcohol: pale yellowish white with brilliant opalescent lustre. Tube: thin inner parchmentlike lining to which is cemented a thin to thick covering of fine mud, forming a long, slender, cylindrical mud tube.

BIOLOGY.—Dredged on bottoms of mud, ooze, and mud with sand or gravel. Found in the stomach of haddock (Georges Bank, 1953, 1954, 1955, R. Wigley).

MATERIAL EXAMINED.—Numerous specimens from Gulf of St. Lawrence (south of Anticosti Island), Nova Scotia to off Chesapeake Bay, *Albatross* stations, in 14 to 1,255 fathoms.

DISTRIBUTION.—Gulf of St. Lawrence to off Chesapeake Bay, West Indies. In 14 to 1,255 fathoms.

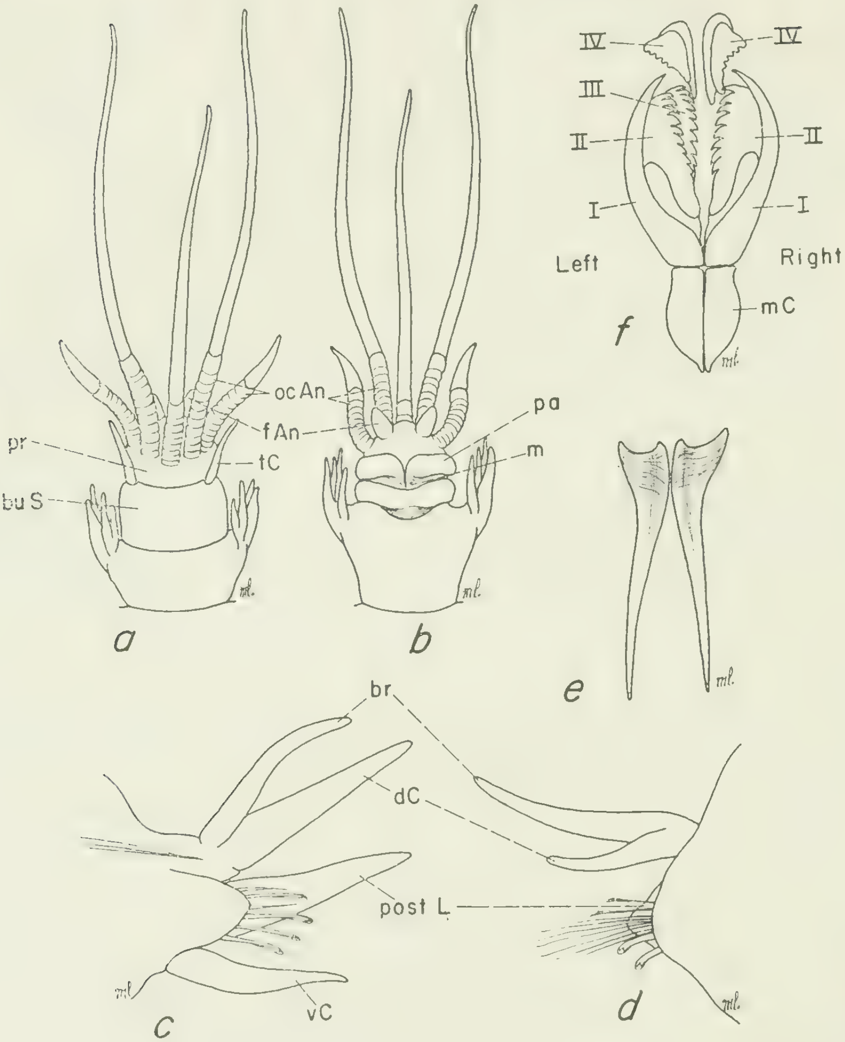

FIGURE 64.—Onuphidae, *Onuphis opalina: a*, dorsal view anterior end; *b*, ventral view anterior end; *c*, parapodium from first setiger, inner or anterior view; *d*, parapoduim from setiger 25; *e*, mandibles; *f*, maxillae.

Onuphis (Nothria) conchylega Sars, 1835

FIGURE 65*a*

Nothria conchylega Verrill, *in* Smith, Harger, and Verrill, 1874, p. 41, pl. 7, fig. 3.—Verrill, 1881, pp. 290, 293, 294, 295, 297, 298, 304, 308, 311, 316.—Webster and Benedict, 1887, p. 724.—Whiteaves, 1901, p. 79.—Hartman, 1944a, p. 340, not pl. 23, fig. 4 (=*Onuphis quadricuspis*); 1944d, p. 85, pl. 5, figs. 105–112, pl. 17, figs. 337–338; not 1945, p. 24.—Pettibone, 1956a, p. 560.—Knox, 1959, p. 110.—Eliason, 1962, p. 253.

Nothria conchyphila Verrill, 1885a, p. 524 (part), not pl. 41, fig. 181 (=*Onuphis quadricuspis*); 1885b, p. 432 (part).

Nothria conchylegia Sumner, Osburn, and Cole, 1913, p. 622.

Onuphis conchylega Fauvel, 1923, p. 415, fig. 164,*a–m;* 1953, p. 255, fig. 128,*a–m.*—Støp-Bowitz, 1948a, p. 64.—Uschakov, 1955, p. 234, figs. 74, 76; 1957, p. 1666.—Berkeley and Berkeley, 1956a, p. 236.—Fauvel and Rullier, 1957, p. 92.—Clark, 1960, p. 23.

Onuphis (*Nothria*) *conchylega* Day, 1957, p. 92; 1960, p. 338.—Knox, 1960a, p. 130.

Description.—Length up to 150 mm., width up to 5 mm., segments up to 150. Prostomium with a pair of large eyes external to the bases of the dorsolateral occipital antennae, with a pair of minute eyes posterior to the frontal antennae. Ceratophores of occipital antennae short, obscurely ringed. Three dorsal occipital antennae subequal in length. Branchiae simple, cirriform (rarely bifid), beginning on setigers 9–13 and continuing to near end of body. Tentacular segment shorter than the following. First setigerous segment nearly twice the length of those following, with parapodia greatly

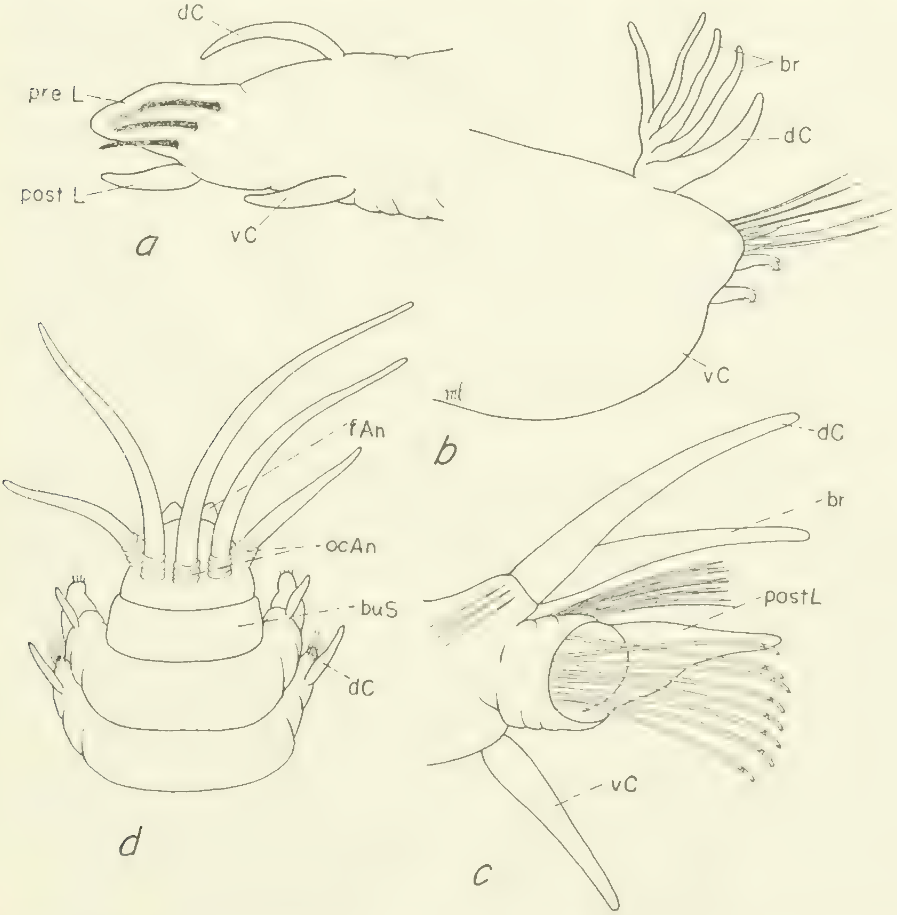

Figure 65.—Onuphidae, *a*, *Onuphis conchylega*, parapodium from first setiger, anteroventra view. *b*, *Onuphis quadricuspis*, parapodium from setiger 20. *c*, *Onuphis eremita*, first setiger (after Claparède, 1868). *d*, *Hyalinoecia tubicola*, dorsal view anterior end.

enlarged and extending well forward beyond the prostomium. Dorsal cirri shorter, atrophied toward setiger 30. Ventral cirri subulate on first 2 setigers. First 2 setigers (fig. 65*a*) with presetal lamellar process large, flat, curved around acicular setae. Acicular hooked setae stout, amber-colored, hooded (unless worn), bidentate (may be worn appearing unidentate). Two long anal cirri.

Color: variable, bluish with red transverse stripes; whitish yellow with violet brown bands, with rust colored spots on bases of parapodia and cirri. Tube: free, elongate rectangular, greatly flattened, scabbard shaped, formed of a thin transparent, parchmentlike lining which is more or less completely covered with small to large, angular, flattened fragments of shells, stones, pebbles, shale. The lumen of the tube is about twice as wide as high, completely filled by the worm. The worm extends out anteriorly from the tube and may drag it along, much like the case of a caddisfly larva.

BIOLOGY.—Found at low water and dredged on bottoms of mud, ooze, gravel, rock, and various combinations of mud, sand, gravel, rocks, coral, and broken shells. One of the most abundant polychaetes in northern waters. Breeding individuals taken in August and September in the Woods Hole region (Moore, MS.). Found in the stomach of haddock (Georges Bank, 1954, 1955, R. Wigley). Some specimens found to be parasitized by the arabellid *Drilonereis caulleryi* (Pettibone, 1957b; see also p. 274).

MATERIAL EXAMINED.—Numerous specimens from Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, south of Anticosti Island), Nova Scotia, Newfoundland to off Florida, *Albatross* stations, in 13 to 1,073 fathoms.

DISTRIBUTION.—Widely distributed in the Arctic. Norway, Iceland, Faroes to France, Mediterranean, Labrador to Florida, West Indies, Bering Sea to British Columbia, southern California to Colombia, north Japan Sea to Japan, Indian Ocean, South Africa, New Zealand. Low water to 2,233 fathoms.

Onuphis (Onuphis) eremita **Audouin and Milne-Edwards, 1833a**

FIGURE 65*c*

Onuphis eremita Fauvel, 1923, p. 414, fig. 163,*a–l;* 1953, p. 257, fig. 129,*a–l.*—Monro, 1930, p. 128, fig. 47; 1934, p. 370.—Hartman, 1944d, p. 75.—Rioja, 1947b, p. 519.—Wesenberg-Lund, 1949, p. 315.—Tebble, 1955, p. 118.—Fauvel and Rullier, 1959, p. 938.—Hartman, 1960b, p. 99.
Onuphis emerita Day, 1960, p. 336.

DESCRIPTION.—Length up to 120 mm., width up to 2 mm., segments up to 200. Prostomium without eyes. Ceratophores of occipital antennae long, ringed (14–25 rings). Dorsolateral pair of occipital antennae longer than the median unpaired one. Branchiae begin on first setiger as a single filament, continuing up to setigers 10–22 or so, then with 2 branches, then 3, with a maximum of 5–7 pectinate filaments, becoming simple in more posterior segments and continuing to near end of body. Ventral cirri subulate on first 5–6 setigers. Special hooked setae of anterior 2 setigers tridentate (bidentate, according to Fauvel). Anal cirri 4, 2 lower ones shorter. Color: metallic violet, darker at bases of parapodia; may have darker rings on buccal and first setigerous segments. Tube: thin membranous lining encrusted with fine sand or mud.

BIOLOGY.—Dredged on bottoms of sand, sand mixed with mud, gravel and shells.

MATERIAL EXAMINED.—Nantucket Sound, Massachusetts, 8 fathoms; off Long Island Sound (35°20′ N., 75°19′ W.), *Albatross* Stations, 15–77 fathoms.

DISTRIBUTION.—Off Long Island Sound, Caribbean Sea to Venezuela and Colombia, Mediterranean, Adriatic, south Arabian coast, Indian Ocean, West and South Africa, China, central California to Mexico, Guatemala. In 8 to 835 fathoms.

Onuphis (Onuphis) quadricuspis **Sars, 1872**

FIGURE 65*b*

Onuphis quadricuspis Sars, 1873, p. 216, pl. 15, figs. 7–19.—McIntosh, 1903, p. 149, pl. 12, figs. 35–37.—Fauvel, 1923, p. 418, fig. 165,*f–p*.—Wesenberg-Lund, 1950a, p. 26; 1951, p. 55.—Fauvel and Rullier, 1959, p. 938.—Eliason, 1962, p. 253.

Nothria conchyphila Verrill, 1885a, p. 524, pl. 41, fig. 181 (part); 1885b, p. 432 (part).

Nothria conchylega Hartman, 1944a, p. 340, pl. 23, fig. 4.—Not Sars, 1835.

DESCRIPTION.—Length up to 60 mm., width up to 2.5 mm., segments more than 100. Prostomium with or without a pair of minute anterior eyes. Ceratophores of occipital antennae short, ringed (about 6 rings). Dorsolateral pair of occipital antennae longer than median unpaired one. Branchiae begin on setigers 5–9, with a maximum of 4–5 pectinate filaments (fig. 65*b*); branchiae absent from a long posterior region. Ventral cirri subulate on first 3 setigers (5 according to Fauvel). Special hooked setae of anterior 5 setigers bidentate (tridentate, according to Fauvel). Anal cirri 4, 2 lower ones shorter. Color, in life: banded reddish brown, 1 wide band per segment; color, in alcohol: pale gray or reddish brown, may be banded. Tube: a cylindrical membranous lining encrusted with mud.

BIOLOGY.—Dredged on bottoms of mud, sandy mud, and mud with gravel, pebbles.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Bay of Chaleurs, south of Anticosti Island, 22–140 fathoms), off Nova Scotia (*Albatross* Station 2504, 44°23′ N., 61°22′ W., 82 fathoms; *Delaware* Station, 43°3′ N., 65°30′ W., 70 fathoms, 1959, R. Wigley), Massachusetts (off Martha's Vineyard, 157 fathoms, by Verrill as *Nothria conchyphila*, figured).

DISTRIBUTION.—Norway, Iceland to English Channel, Azores, West Africa, Gulf of St. Lawrence to off Massachusetts. In 22 to 808 fathoms.

Genus *Diopatra* Audouin and Milne-Edwards, 1833a

Type (designated by Hartman, 1959a): *Diopatra amboinensis* Audouin and Milne-Edwards, 1833a. Contains only one New England species.

Diopatra cuprea (Bosc, 1802)

FIGURE 66

Diopatra cuprea Verrill and Smith, 1874, pp. 52, 70, 77, 83, 128, 137, 140, 299, pl. 13, figs. 67–68.—Webster, 1879, p. 236; 1886, p. 144.—Verrill, 1881, pp. 301, 317, 322, 323, pl. 4, fig. 5.—Webster and Benedict, 1884, p. 720.—Andrews, 1891a, p. 285; 1891b, p. 113.—Not Wilson, 1882, p. 288 (= *Onuphis magna* (Andrews).—Linville, 1903, p. 231.—Sumner, Osburn, and Cole, 1913, p. 621.—Monro, 1924, p. 193; 1933b, 71.—Treadwell, *in* Cowles, 1930, p. 343.—Hartman, 1944a, p. 340, pl. 17, fig. 17; 1944d, p. 54, pl. 1, figs. 9–14; 1945, p. 26; 1951, p. 51.—Allen, 1951, p. 134; 1952, p. 197; 1953, p. 572; 1959, p. 339, pls. 1–5.—Renaud, 1956, p. 21, fig. 16.—Costello, et al., 1957, p. 73.—Day, 1960, p. 350.

DESCRIPTION.—Length up to 300 mm., width up to 10 mm., segments up to 250. Anterior part of body cylindrical, rest flattened dorsoventrally, tapering rather abruptly posteriorly. Integument in general with thick iridescent cuticle, ringed or wrinkled. Prostomium (fig. 66*a*) suboval with pair of short conical frontal antennae and 5 occipital antennae with ceratophores ringed (about 8–10 rings), the styles of the 3 dorsal ones subequal, longer than the 2 ventrolateral ones. A pair of sensory organs present posterior to the bases of the dorsolateral occipital antennae (sometimes incorrectly called eyes), pale translucent raised circular areas. Ventrally a pair of large globular palps present. Single buccal segment about same length as the following, with a pair of subulate tentacular cirri; ventrally with a larger arched lower lip.

Parapodia of first 4 setigerous segments modified, slightly enlarged, extending anteriorly and ventrally, with short conical presetal lobes and longer conical postsetal lobes, with few slender setae with capillary curved tips and five or so curved hooded hooked setae with bidentate tips. Dorsal cirri short, subulate on anterior few segments, extending beyond the parapodial lobes, becoming longer, cirriform more posteriorly. Ventral cirri short, conical on first 4 setigers, shorter, oval to conical on setiger 5, wide flat cushionlike from setiger 6 on.

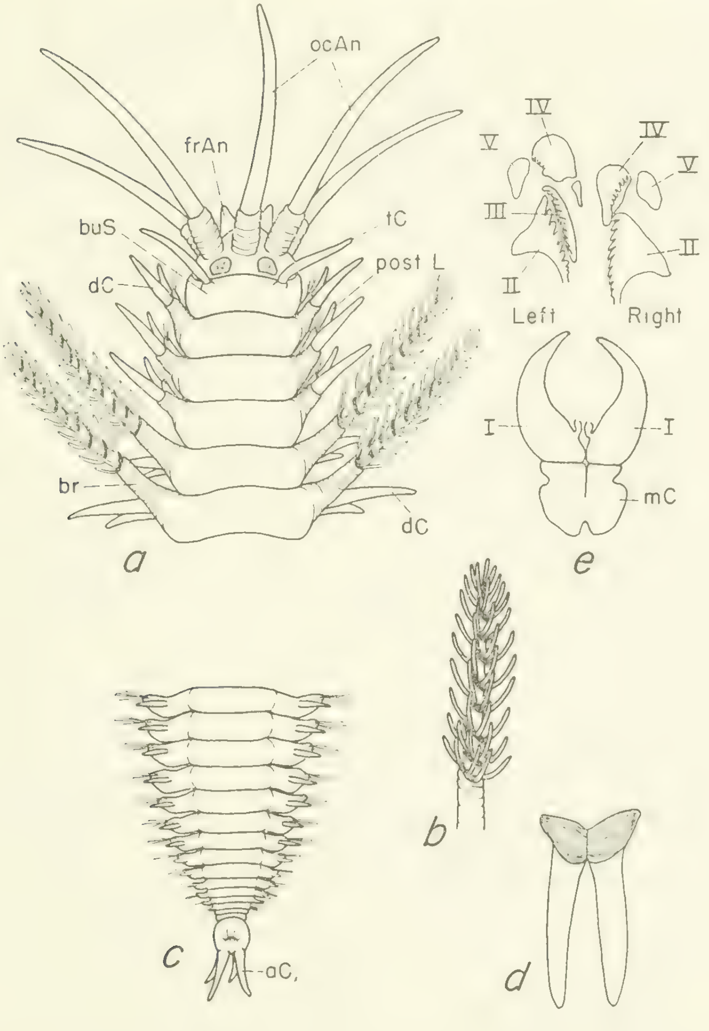

FIGURE 66.—Onuphidae, *Diopatra cuprea* (*d–e*, after Moore, MS.): *a*, dorsal view anterior end; *b*, 1 of spiralled branchia; *c*, dorsal view posterior end; *d*, mandibles, ventral view; *e*, dorsal view maxillae, the anterior accessory pieces of maxillae V displaced.

Branchiae (fig. 66,*a*,*b*) begin on setigers 4 or 5, arising on the inner side of the bases of the dorsal cirri, with a short, cylindrical, more or less ringed base, with branchial filaments emerging in spiral fashion from a central stem. Stem and filaments each with 2 blood vessels. Branchiae largest anteriorly, getting smaller with fewer branches more posteriorly, the more posterior branchial segments with 2 and then a single short branch. Usually about 30 pairs of branchiae (up to 43, fewer on smaller specimens). Anterior branchial segments with straight and curved setae with fine tips. Middle and posterior branchial segments with central conical lobe surrounded by ring of setae, with setae of 3 kinds: (1) Upper bundle of short comb setae with tips flared, truncate, straight or slightly diagonal, frayed into numerous fine teeth (14–20 or so); (2) numerous limbate setae with fine tips; (3) 2 stout short subacicular setae with tips bidentate, hooded.

In addition in posterior abranchial region, parapodia with 5 or so acicula with sharply tapered tips projecting from the parapodial lobe; acicula and setae yellow or light amber colored. Anal end (fig. 66*c*) with 4 short anal cirri ventrally on prominent anal ring. Proboscis with a pair of black and white wing-shaped mandibles, flared anteriorly, articulated medially (fig. 66*d*). Maxillae (fig. 66*e*) rather thin, light brown with darker brown teeth. Maxillae I falcate hooks, with pair of short suboval embedded maxillary carriers; maxillae II with 8–12 teeth; left maxilla III with 8–10 teeth; right maxilla III lacking; left maxilla IV forming a ring with 4–7 teeth; right maxilla IV forming a larger ring with 8–10 teeth; maxillae V forming rudimentary plates each with an inconspicuous tooth.

Color: brilliantly iridescent, opalescent, reddish to deep brown speckled with grey. Parapodia yellowish brown, speckled with light red to dark brown. Males cream to yellowish. Females grey green (eggs greenish). Tube: a permanent type tube up to 3 feet or more in length, the major part embedded in the substratum, the distal few inches may project above the substratum. The tube is soft, white to dark grey, thick, tough, parchment-like. The distal exposed part widens to a lateral vent, coarsely covered with foreign material of various kinds, having an exceedingly ragged and untidy appearance. Often a larger shell helps protect the opening.

BIOLOGY.—Found on sheltered mud and sand flats mixed with debris, shell particles, and gravel from high to low tide level and below. They are found in sand flats associated with oysters, clams, etc. They live in permanent tubes, the distal end of which is raised above the substratum for several inches and covered with foreign objects. They are dredged on all kinds of bottom, the dredge often bringing up large quantities of the projecting ends of the tubes, the occupant usually escaping. The foreign material of the tubes varies with the habitat. On sandy beaches, they incorporate shell and algal fragments, small stones, the edges projecting horizontally. On muddy shores they incorporate vegetable fragments, including long pieces of eel grass, fine sticks. Luxuriant growths of living algae and hydroids may adorn many tubes.

They protrude from the anterior end of the tube for some distance, drawing back food or tube building materials. They withdraw quickly below the surface when disturbed. They are able to turn readily within the tube. Worms with regenerating anterior and posterior ends are commonly found, a small miniature end forming first, gradually getting larger. They will regenerate lost parts in a relatively short time.

When incorporating foreign material in the tube (Linville, 1903), the tentacular cirri and ventral palps are used as feelers. Objects to be incorporated in the tube are picked up or pushed by the strong ventral palps or by the mandibles, the body contracts and the object is placed on the edge of the tube. The worm glues the object to the tube securely by pushing outward, rubbing the ventral mucous glands against the inner surface of the tube. According to Linville, while in the tube, the worm moves the body up and down regularly at the rate of 44 times per minute; this creates currents of water passing in and out of the tube for aeration. Other respiratory movements include an alternate movement of the branchiae outwardly and inwardly, an alternate spiral constriction and reverse spiral extension of the entire branchia, and the waving of the minute branchial filaments toward and away from the central stem. The adults are hardy and their tube-building habits can be observed readily. They are carnivorous. They can be kept alive in the laboratory by feeding them *Mytilus* (Allen, 1959).

According to Andrews (1891b), in North Carolina the young were found in the tow net in July. According to Monro (1924) in Panama, developing eggs and larvae were found in the tubes of the adult, the eggs evidently being laid in the tube where the larvae developed. The early development has been followed to some extent by Andrews (1891b, Beaufort, North Carolina), Monro (1924, Madeira, Panama), and Allen (1951, 1953, and 1959, Woods Hole region, Massachusetts). Allen found that the eggs were mature and could be artificially fertilized in June through August (more successful in June and July than in August); a rather low percentage of activation was the general rule. The eggs were up to 240μ in diameter, very opaque, creamy yellow to greenish; during maturation, the eggs had algal-like strings of nurse cells attached.

After fertilization, development took place with amazing rapidity. At 3 hours, there were ciliated larvae, at 24 hours rotating trochophores. They developed into surface swimmers for a relatively short time, the larvae of 4 days tending to crawl on the bottom, secreting mucus and forming transparent slime tubes (larvae with four setigers and moveable jaws). At 5 days, they had settled on the bottom, in transparent slime tubes and appeared to be feeding (larvae with 4–5 setigers, 5 occipital antennae, 2 anal cirri, 4 types of setae); at 13 to 17 days, the larvae had seven setigers, with jaws working actively.

Allen (1952) found *D. cuprea* to be parasitized by a species of arabellid; 63 specimens of the parasite were recovered from a single specimen of the host, ranging in size from a few (7) to numerous (about 110) segments. The parasites are considered to be possibly the young of *Notocirrus spiniferus* (Pettibone, 1957b; see also p. 275).

MATERIAL EXAMINED.—Numerous specimens from Massachusetts (Duxbury, Woods Hole region, Nantucket Sound, Vineyard Sound, Buzzards Bay; Cape Cod, Provincetown, Wellfleet, Barnstable), Rhode Island (Potters Pond, Plum Beach), Virginia (Chincoteague Bay area, Chesapeake Bay), North Carolina (Beaufort), South Carolina (Skull Creek, Parris Island), Mississippi (Biloxi), Louisiana (Sabine Lake).

DISTRIBUTION.—Massachusetts (Duxbury) to Florida, West Indies, Gulf of Mexico, Panama, south to Brazil. In low water to 45 fathoms.

Genus *Hyalinoecia* Malmgren, 1867

Type (monotypy): *Hyalinoecia tubicola* (O. F. Müller, 1776). Contains only one New England species.

Hyalinoecia tubicola (O. F. Müller, 1776)

FIGURE 65*d*

Hyalinoecia artifex Verrill, 1880, p. 357; 1885a, p. 524, pl. 41, figs. 178–179; 1885b, p. 429.—Procter, 1933, p. 139.

Hyalinoecia tubicola stricta Moore, 1911, p. 280, pl. 18, figs. 96–97.

Hyalinoecia tubicola Augener, 1906, p. 135.—Fauvel, 1923, p. 421, figs. 166,*i–q;* 1953, p. 261; 1957b, p. 214.—Chamberlin, 1919, p. 315.—Monro, 1936, p. 152.—Berkeley and Berkeley, 1941, p. 37.—Hartman, 1944a, p. 340, pl. 14, fig. 6, pl. 17, figs. 14–15; 1944d, p. 46; 1951, p. 52.—Støp-Bowitz, 1948a, p. 65.—Wesenberg-Lund, 1950a, p. 27; 1950b, p. 69.—Fauvel and Rullier, 1959, p. 939.—Knox, 1960a, p. 126.—Clark, 1960, p. 23.—Day, 1960, p. 356.

DESCRIPTION.—Length up to 215 mm., width up to 8 mm., segments up to 180. Body nearly linear, depressed dorsoventrally except on anterior end. Prostomium short, subconical, with 2 ovoid frontal antennae, 5 occipital antennae with short, faintly ringed bases or ceratophores, the 3 dorsal occipital antennae longer than the ventrolateral ones, the median one the longest. Usually without eyes (may be present, especially in young). A pair of large globular ventral palps present. First or tentacular segment a short apodous ring without tentacular cirri. First setigerous segment about twice as long as the tentacular segment, with parapodia enlarged, turned forward and downward, clawlike. Second setigerous segment slightly longer than the following. Parapodia of second and third setigers somewhat enlarged and turned downward and slightly forward. From the fourth setiger on, parapodia directed laterally. Dorsal cirri short, subulate, nearly as long as the parapodial lobes, becoming more cirriform toward setiger 30.

Branchiae begin on about setiger 25 (18–33), beginning as a small simple cirriform filament at the bases of the dorsal cirri, becoming longer, slender, equal to about a half to three-fourths of the body width, continuing as a simple filament to near posterior end. Ventral cirri on first 3 setigers short, subulate, about same length as dorsal cirri; on setiger four, short, conical; from setiger five on, forming low cushionlike lobes. Setae of first setiger consist of few heavy dark amber-colored curved acicular setae, tapered to blunt tips. Setae of second setiger acicular, pointed, flared distally to a frayed or pectinate tip. Rest of parapodia of prebranchial region with (1) limbate setae with pointed tips and (2) short delicate pectinate setae. Parapodia of branchial region with lobes conical and, in addition to the above 2 types of setae, with 2 stout bidentate acicular hooked setae and usually 3 projecting acicula; setae and acicula light amber colored. With 2 long filiform anal cirri on ventral side of furrowed anal ring.

Proboscis with a pair of calcified white winglike mandibles. Maxillae light amber colored, with a pair of embedded short oval maxillary carriers; maxillae I, hooked forceps; maxillae II with about 13 teeth (12–17); left maxilla III with about 12 teeth (8–18), right maxilla III missing; maxillae IV forming anterior curved rings with about 10 teeth (4–11); maxillae V rudimentary or with a single tooth.

Tube: Free, unattached, cylindrical, firm, tough, transparent, quill-like, colorless or yellow, open at both ends; sufficiently transparent so the large iridescent worm can be seen within. The tube tapers gradually, with one end larger than the other (the anterior end of the worm is at the larger end of the tube). Wall of the tube thickest in the middle, where it may be very thick and tough, difficult to cut, diminishing in thickness toward the gently curved and tapered larger elliptical end where it is thin and semicollapsible. Tube composed of successive layers of a tough secretion and is marked by faint annular rings; both orifices guarded from intrusion by several pairs (usually 3 pairs) of soft membranous valves, closing the opening but allowing the occupant to move out.

BIOLOGY.—Dredged on bottoms of soft mud, sand, mud mixed with pebbles, gravel, rocks, shells. The free tube in which the worm lives evidently lies free on the surface, the worm protruding from the tube and dragging it about. The tube may be slick and clean or it may have other organisms attached to it, as hydroids, anemones, sponges, barnacles, and tunicates.

MATERIAL EXAMINED.—Numerous specimens from off Massachusetts to off North Carolina, West Indies, Gulf of Mexico, 67 to 966 fathoms.

DISTRIBUTION.—A cosmopolitan species in abyssal depths. Greenland, Norway, North Sea, English Channel, off Canaries and Azores, Mediterranean, Red Sea, Davis Strait, Gulf of Maine to off Florida, West Indies, Gulf of Mexico, off Brazil, Argentina, Siberia, Japan, off southern California, Galápagos, Panama, Peru, East Indies, New Zealand, Indian Ocean, West and South Africa. In 7 to 2,393 fathoms.

Family Lumbrineridae (=Lumbriconereidae and Lumbrinereidae)

Body elongate, cylindrical, linear, tapering slightly anteriorly and more so posteriorly. Prostomium (fig. 67,*a*,*d*,*g*) reduced to a simple, conical or subspherical lobe, usually without appendages (may be minute antennae or papillae at posterior border), usually without eyespots. A pair of inconspicuous nuchal organs present in fossa between the prostomium and first segment. Ventrally a pair of buccal cushionlike lips present (sometimes referred to as palps, fig. 69*b*). First 2 segments apodous, may be more or less fused ventrally, forming longitudinal ridges of the lower lip.

Parapodia essentially uniramous. Notopodium may be represented by a dorsal bundle of embedded fine acicula. Neuropodium with simple, bilimbate setae with fine tips (fig. 69,*e*,*f*) and hooded hooks or crotchets, the latter simple (fig. 69*g*) and/or compound (fig. 67,*c*,*f*). Without dorsal and ventral cirri; usually with 4 short anal cirri (fig. 70*b*); with (fig. 68*b*) or without parapodial branchiae. Proboscis eversible, with elaborate dark chitinized jaw pieces (may be partially calcified), consisting of a pair of ventral flat blades, the mandibles (partially fused anteromedially, flared anteriorly, fig. 69,*h*,*i*) and 4 pairs of more dorsal symmetrical maxillae. Maxillae I, the forceps, hinged to a pair of short broad maxillary carriers which are embedded in the pharyngeal muscles; maxillae II–IV simple or toothed (fig. 69,*h*,*j*).

The lumbrinerids are usually long, threadlike, often coiling in long spirals. They break up easily, making it difficult to obtain entire specimens. They are chiefly carnivorous and burrowing. In the few forms where early development has been observed (as *Lumbrineris latreilli* by Okuda, 1946; *Lumbrineris* sp. by Fewkes, 1883), large yolky eggs are laid in gelatinous masses, attached to the mud or algae, the early stages being passed within the gelatinous masses. The young larvae of 4 or more setigerous segments crawl out, thus having a nonpelagic development.

Both genera represented have the prostomium without antennae.

Key to the New England Genera of Lumbrineridae

1. Without palmately branched branchiae on parapodia . . **Lumbrineris** (p. 257)
With palmately branched branchiae on some parapodia (fig. 68*b*).
Ninoë (p. 266)

Genus *Lumbrineris* Blainville, 1828

Lumbriconereis Grube, 1840; =*Lumbrinereis* Delle Chiaje, 1841.

Type (herein designated): *Lumbrineris ebranchiata* (Pallas, 1788).

All the species represented have the prostomium conical to rounded, without appendages, without eyes. Ventrally a pair of buccal cushions or palps present. Proboscis with paired ventral mandibles fused medially, with slender bases and flaring anterior ends (fig. 69, *h,i*). Maxillae I, the forceps, stout, hooked, with short, broad maxillary carriers (fig. 69,*h,j*).

Key to the New England Species of *Lumbrineris*

1. Anterior parapodia provided with simple limbate setae and compound hooded hooks or crotchets (fig. 67,*b,c*); acicula yellow 2
Anterior parapodia without compound hooded hooks or crotchets . . . 3
2. Prostomium subglobular or rounded (fig. 67*d*); blades of compound hooded hooks rather short (fig. 67*f*) . . . . **L. coccinea** (p. 257)
Prostomium conical (fig. 67*a*); blades of compound hooded hooks longer (fig. 67*c*) . . . . **L. latreilli** (p. 258)
3. Prostomium long, acutely conical, 2 or 3 times as long as wide (fig. 67*g*).
L. acuta (p. 260)
Prostomium short, conical 4
4. Anterior parapodia with short conical postsetal lobe (fig. 68*h*).
L. brevipes (p. 260)
Anterior parapodia otherwise 5
5. Acicula black; setae dark at base . . . . **L. fragilis** (p. 262)
Acicula yellow; setae light yellow or pale 6
6. Simple hooded hooks of anterior segments long winged (appear as worn or incompletely formed limbate setae); posterior parapodia without elongated postsetal lobe . . . . **L. impatiens** (p. 265)
Simple hooded hooks of anterior segments short winged (fig. 70*h*); posterior parapodia with postsetal lobe elongate, often erect (fig. 70*d*).
L. tenuis (p. 264)

Lumbrineris coccinea (Renier, 1804)

FIGURE 67,*d–f*

Lumbriconereis floridana Ehlers, 1887, p. 103, pl. 30, figs. 10–15.

Lumbriconereis coccinea Fauvel, 1923, p. 432, fig. 172,*g–n;* 1957b, p. 214.—Fauvel and Rullier, 1959, p. 948.

Lumbrineris inflata Hartman, 1944d, p. 160; 1951, p. 59; 1956, pp. 253, 288; 1960b, p. 321.

Lumbrinereis inflata Berkeley and Berkeley, 1948, p. 97, figs. 150–152.

Lumbrinereis coccinea Day, 1953, p. 436; 1957, p. 95.

Description.—Length up to 170 mm., width up to 1.5 mm., segments up to 140. Parapodia similar along length of body. Presetal lobe short, rounded. Postsetal lobe prominent, digitiform, directed laterally or obliquely upward. Anterior parapodia with capillary, arched limbate setae and compound hooded hooks with rather short blades (fig. 67*f*). Middle and posterior parapodia with mostly simple hooded hooks. Acicula yellow. Proboscis with maxillae ii each with 4–6 teeth; maxillae iii each with 2 teeth (3–4 in var. *inflata*); maxillae iv each with a single tooth (or 2 in var. *inflata*). Color: orange red to pale yellow orange.

Biology.—Found at low water under stones, inhabiting crevices in calcareous algae (*Lithothamnion*), in roots of sea basket grass (*Phyllospadix*), and among serpulids. Dredged on bottoms of mud, muddy sand, sand, among serpulids, bryozoans, shells, and coral rock.

Material examined.—Numerous specimens from Washington (Strait of Juan de Fuca, Washington and Puget Sound, low water to 140 fathoms), Alaska (New Harbor, Unga Island, low water, 1872, W. H. Dall), off Massachusetts (*Albatross* III, 42°20′ N., 66°45′ W., 182 fathoms, 1957, R. Wigley; U.S. Fish Commission Location 945, 39°58′ N., 71°13′ W., 207 fathoms, 1881; Location 998, 39°43′ N., 71°32′ W., 302 fathoms, 1881; *Albatross* Station 2249, 40°11′ N., 69°52′ W., 53 fathoms), off Florida (*Albatross* Station 2415, 30°44′ N., 79°26′ W., 440 fathoms; Seahorse Key; Key West), West Indies (Boqueron Bay and Mayaguez Harbor, Puerto Rico; St. Thomas Island).

Distribution.—English Channel to Mediterranean, off Massachusetts to Florida, Bermuda, West Indies, Gulf of Mexico, Alaska to Gulf of California, Japan, West and South Africa. Low water to 710 fathoms.

Lumbrineris latreilli (Audouin and Milne-Edwards, 1833a)

Figure 67,*a–c*

Lumbriconereis latreilli Fauvel, 1923, p. 431, fig. 171,*m–r*; 1953, p. 266, fig. 134,*m–r*; 1957b, p. 214.—Okuda, 1946, p. 120, pls. 12, 13.—Wesenberg-Lund, 1949, p. 315; 1950a, p. 28; 1950b, p. 71; 1951, p. 57.—Fauvel and Rullier, 1959, p. 947.

Lumbrineris latreilli Hartman, 1944d, p. 158, pl. 9, figs. 213–216.

Lumbrinereis latreilli Berkeley and Berkeley, 1948, p. 98, figs. 154–156.—Day, 1953, p. 435; 1957, p. 94; 1960, p. 361.—Rioja, 1958, p. 268.—Clark, 1960, p. 23.

Description.—Length up to 300 mm., width up to 5 mm. Parapodia with presetal lobe short, rounded, with postsetal lobe longer, bluntly cirriform, projecting obliquely upward. Anterior parapodia with simple arched limbate setae and compound hooded hooks (fig. 67,*b,c*). Middle and posterior parapodia with few

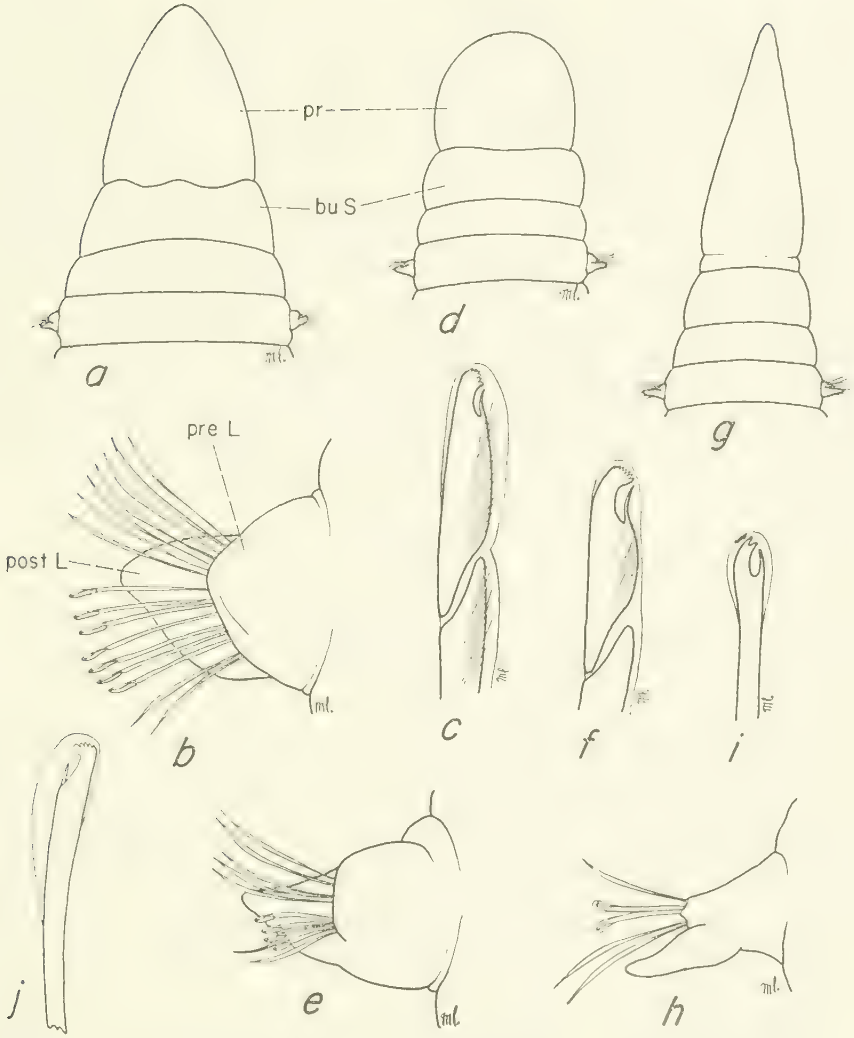

FIGURE 67.—Lumbrineridae, *a–c*, *Lumbrineris latreilli:* *a*, dorsal view anterior end; *b*, anterior parapodium, anterior view; *c*, compound hooded crotchet or hook from anterior parapodium. *d–f*, *Lumbrineris coccinea;* *d*, dorsal view anterior end; *e*, anterior parapodium, anterior view; *f*, compound hooded crotchet from anterior parapodium. *g–i*, *Lumbrineris acuta:* *g*, dorsal view anterior end (after Verrill, 1875); *h*, middle parapodium, dorsal view; *i*, hooded crotchet from same. *j*, *Lumbrineris impatiens*, simple hooded hooked seta from posterior region (after Fauvel, 1923).

capillary limbate setae and simple hooded hooks. Acicula yellow to amber colored. Proboscis with maxillae II each with 4-5 teeth; maxillae III each with 2 teeth; maxillae IV each with a single tooth. Color: pale pink, orange or brown, with metallic iridescence.

BIOLOGY.—Found at low water in muddy sand, under stones, among roots of eelgrass, *Zostera.* Dredged on bottoms of mud and sand. According to Okuda (1916) in Japan, they spawn from the middle to the end of June. Bright orange eggs, rich in yolk, are laid in thick gelatinous masses attached to *Zostera* and *Sargassum*, where early development takes place. Development is much abbreviated and rapid, with adult structures appearing early, the larvae lacking pelagic or swimming stages. Larvae of 4 to 7 setigerous segments creep out of the gelatinous masses.

Material examined.—New Brunswick (St. Andrews), Maine (41°09′ N., 66°02′ W.) to off North Carolina (35°02′ N., 75°12′ W.), numerous *Albatross* Stations, 48 to 1,290 fathoms; Florida (Seahorse Key).

Distribution.—A cosmopolitan species. Greenland, Norway, Iceland to France, Mediterranean, Adriatic, off New Brunswick to North Carolina, Gulf of Mexico, Queen Charlotte Islands to California, Mexico, Peru, Japan, Indian Ocean, Red Sea, Persian Gulf, West and South Africa. Low water to 1,290 fathoms.

***Lumbrineris acuta* (Verrill, 1875)**

Figure 67,*g–i*

Lumbriconereis acuta Verrill, 1875, p. 39, pl. 3, fig. 5.
Lumbrineris acuta Hartman, 1942c, p. 114, fig. 10,*a–d*; 1944a, p. 340, pl. 17, fig. 6; 1944d, p. 145, pl. 8, figs. 176–177.

Description.—Length up to 40 mm., width up to 1 mm., segments up to 125. Parapodia very small, inconspicuous on about first 10 setigers; rest of parapodia with short, cushionlike presetal lobe and a longer prominent postsetal lobe. Parapodia of anterior region with limbate setae only; in middle region, with limbate setae and simple hooded hooks with bidentate tip (fig. 67,*h,i*). Acicula pale yellow. Proboscis with maxillae II each with 3 stout teeth; maxillae III and IV each with a single tooth.

Biology.—Found at low water on mud and sand flats. Dredged on bottoms of mud and coarse to medium sand. Found in stomach of haddock (Georges Bank, 1953, R. Wigley).

Material examined.—Off Maine (*Albatross* III, 41°23′ N., 66°44′ W., 1953, R. Wigley), Massachusetts (Georges Bank, 19–47 fathoms; off Martha's Vineyard, southwest ledge).

Distribution.—Off Maine to Long Island Sound, southern California to western Mexico. Low water to 103 fathoms.

***Lumbrineris brevipes* (McIntosh, 1903)**

Figure 68*h*

Lumbriconereis brevipes McIntosh, 1903, p. 147, text-fig. 3, pl. 12, figs. 33–34.
Ninoë fusca Moore, 1911, p. 285, pl. 19, figs. 110–118.
Lumbrinereis antarctica Monro, 1930, p. 138, fig. 51.

Description.—Length ? (none complete), width up to 2 mm. Prostomium rather sharply conical, with a deep nuchal pocket between the prostomium and first segment enclosing a retractile globular papilla (not always visible). Parapodia with short rounded presetal lobe, with a slender digitiform postsetal process on the anterior parapodia (fig. 68*h*). The postsetal lobes rather prominent on about first 40 segments, gradually becoming smaller and reduced to a small papilla. The lobes contain a vascular loop (they were referred to as a 1-lobed branchia by Moore for *Ninoë fusca*); in the far posterior region, the short postsetal lobe is more conspicuous (observed in a posterior fragment). Anterior parapodia with limbate capillary setae. Middle parapodia with some long-winged simple hooks (appear as worn or incompletely formed limbate capillaries). More posterior parapodia with short-winged simple hooks. Lower half of setae dark, distal half yellow. Acicula black. Proboscis with maxillae II each with 3 large

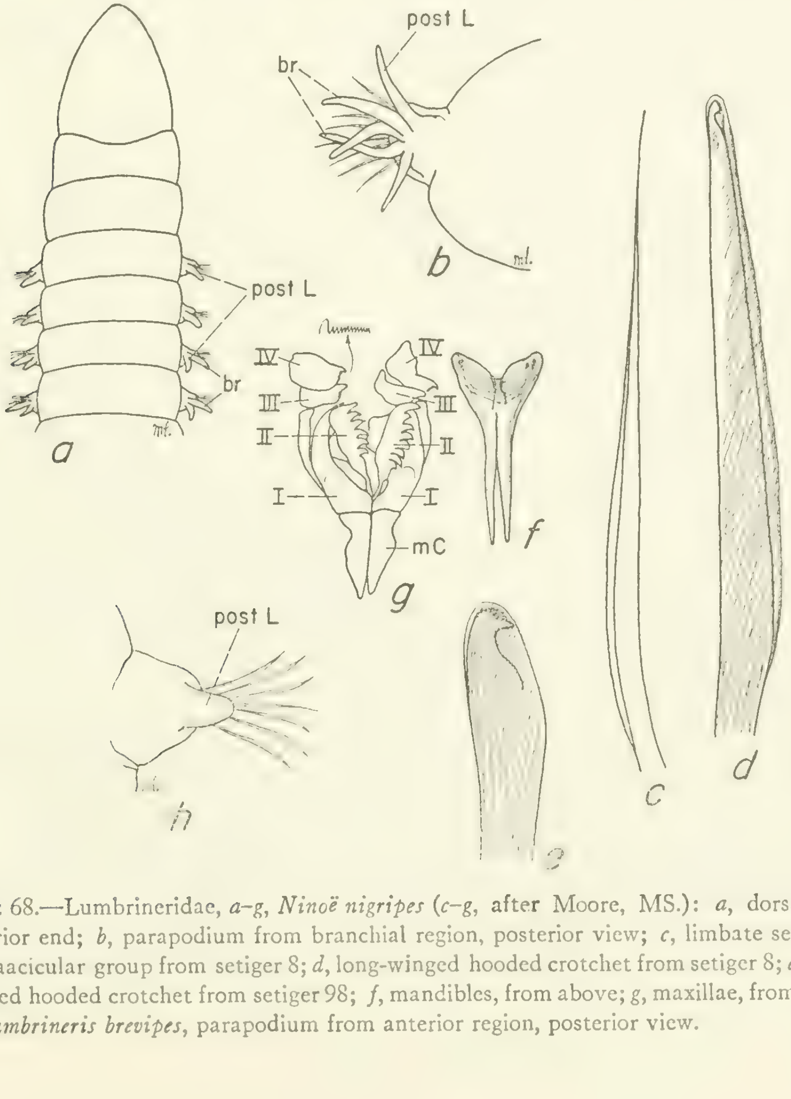

FIGURE 68.—Lumbrineridae, *a–g*, *Ninoë nigripes* (*c–g*, after Moore, MS.): *a*, dorsal view anterior end; *b*, parapodium from branchial region, posterior view; *c*, limbate seta from supraacicular group from setiger 8; *d*, long-winged hooded crotchet from setiger 8; *e*, short-winged hooded crotchet from setiger 98; *f*, mandibles, from above; *g*, maxillae, from above. *h*, *Lumbrineris brevipes*, parapodium from anterior region, posterior view.

teeth; maxillae III slender, triangular, each with a single tooth; maxillae IV large, triangular, each with a single tooth.

BIOLOGY.—Dredged on bottoms of mud, sand and ooze.

MATERIAL EXAMINED.—Off Massachusetts (40°15′ N., 67°05′ W.) to off North Carolina (35°49′ N., 74°34′ W.), several *Albatross* stations, 58 to 1,299 fathoms.

DISTRIBUTION.—Off northwest Spain, off Massachusetts to North Carolina, off southern California, Antarctic (Palmer Archipelago). In 58 to 2,228 fathoms.

***Lumbrineris fragilis* (O. F. Müller, 1776)**

FIGURE 69

Lumbrinereis fragilis Verrill, 1881, pp. 297, 299, 301, 304, 308, 311, 316.—Webster and Benedict, 1884, p. 720; 1887, p. 725.—Procter, 1933, p. 140.—Berkeley and Berkeley, 1956a, p. 236.—Clark, 1960, p. 23.—Eliason, 1962, p. 253.

Lumbrinereis acicularum Webster and Benedict, 1887, p. 725, pl. 4, figs. 55–59.

Lumbriconereis fragilis Whiteaves, 1901, p. 80.—Fauvel, 1923, p. 430, fig. 171, *k,l*.—Uschakov, 1955, p. 242.

Lumbrineris fragilis Pettibone, 1954, p. 275, fig. 31,*h–n*; 1956a, p. 560.

DESCRIPTION.—Length up to 380 mm., width up to 12 mm., segments up to 340. Parapodia with presetal lobe short, rounded, with postsetal lobe longer, rounded, diagonally truncate (fig. 69*c*), becoming somewhat digitiform and extending dorsally in middle and posterior segments (fig. 69*d*). Parapodia of anterior region with setae all simple, arched, limbate, with fine capillary tips (fig. 69*e*). Simple hooded hooks beginning on about setiger 30 (15–50; fig. 69*g*). Setae dark amber colored on basal half. Acicula black. Proboscis with maxillae II each with 4–5 teeth; maxillae III with usually a single tooth (may be 2); maxillae IV each with a single tooth (fig. 65*j*). Color: iridescent, reddish orange or brown, yellowish with whitish transverse bands.

BIOLOGY.—Found at low water on bottoms of mud, muddy sand, gravelly mud, and shifting sand. Dredged on bottoms of sticky and soft mud, silty clay, various combinations of mud, sand, gravel, pebbles, stones, worm tubes, shells, and detritus. They have been found in the stomach of cod and haddock. They contain large eggs in August in the Woods Hole area (Moore, MS.).

MATERIAL EXAMINED.—Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, south of Anticosti Island, 4–140 fathoms), Newfoundland, Nova Scotia (Cape Breton Island), New Brunswick (St. Andrews), Maine (Robbinston and Red Beach, St. Croix River; Glen Cove, mouth of Penobscot Bay; Muscongus Bay near Hog Island; Boothbay Harbor region), New Hampshire (mouth Sagamore Creek; Hampton Beach), Massachusetts (Georges Bank, 27–185 fathoms; Marblehead;

Woods Hole region; Nantucket Sound; Massachusetts and Cape Cod Bays), Virginia (Chincoteague Bay area).

DISTRIBUTION.—Widely distributed in the Arctic. Also Iceland, Faroes, Norway to Azores, Madeira, Mediterranean, Hudson Bay to Virginia, Bering Sea, Alaska, north Japan Sea. Low water to 1,883 fathoms.

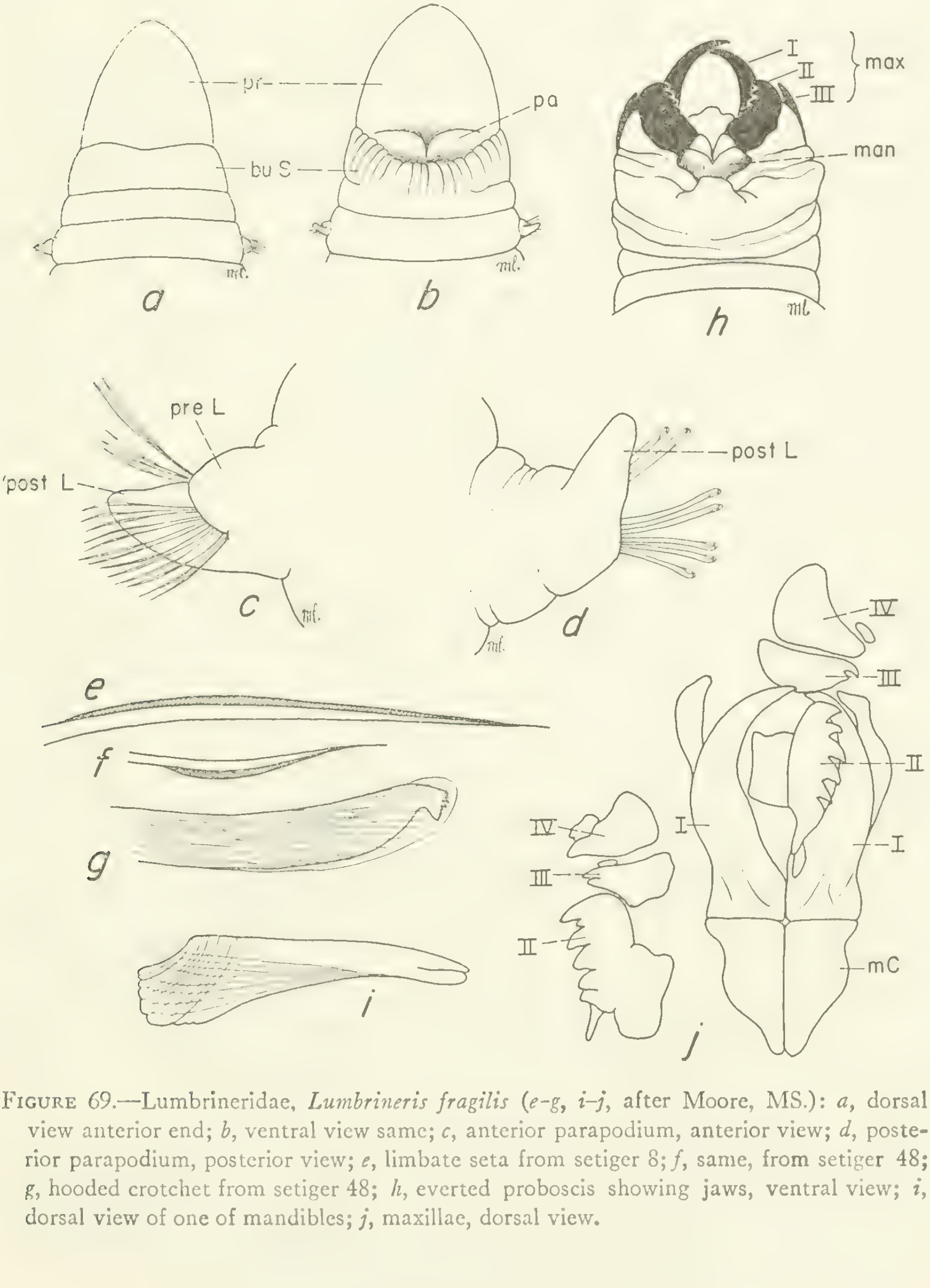
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FIGURE 69.—Lumbrineridae, *Lumbrineris fragilis* (*e–g*, *i–j*, after Moore, MS.): *a*, dorsal view anterior end; *b*, ventral view same; *c*, anterior parapodium, anterior view; *d*, posterior parapodium, posterior view; *e*, limbate seta from setiger 8; *f*, same, from setiger 48; *g*, hooded crotchet from setiger 48; *h*, everted proboscis showing jaws, ventral view; *i*, dorsal view of one of mandibles; *j*, maxillae, dorsal view.

Lumbrineris tenuis (Verrill, 1873a)

FIGURE 70

Lumbriconereis tenuis Verrill and Smith, 1874, pp. 26, 38, 70, 77, 83, 128, 300.—Webster, 1879, p. 241; 1886, p. 145.

Lumbrinereis tenuis Verrill, 1881, pp. 301, 317, 322.—Webster and Benedict, 1884, p. 720.—Treadwell, *in* Cowles, 1930, p. 342.—Stickney, 1959, p. 15.

Lumbrinereis hebes Verrill, 1881, pp. 308, 314, 320.—Webster and Benedict, 1887, p. 725.

? *Lumbriconereis* sp. Fewkes, 1883, p. 197, pl. 7.

Lumbrineris hebes Sumner, Osburn, and Cole, 1913, p. 623.

Lumbrineris tenuis Sumner, Osburn, and Cole, 1913, p. 623.—Hartman, 1942b, p. 54; 1944a, p. 340, pl. 17, figs. 3–5.

Lumbrineris bassi Hartman, 1944d, p. 150, figs. 217–223; 1951, p. 58.

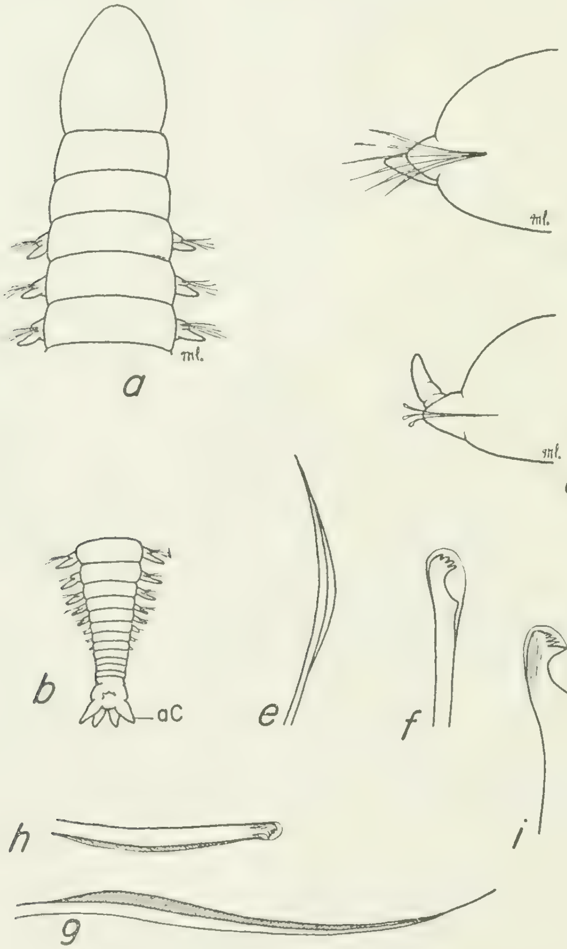

FIGURE 70.—Lumbrineridae, *Lumbrineris tenuis* (*g–j*, after Moore, MS.): *a*, dorsal view anterior end; *b*, dorsal view posterior end; *c*, parapodium from anterior region, anterior view; *d*, same, from far posterior region; *e*, capillary limbate seta; *f*, hooded crotchet; *g*, capillary supraacicular limbate seta from setiger 8; *h*, hooded crotchet from same, somewhat rotated; *i*, same, from setiger 48; *j*, same, from setiger 98.

DESCRIPTION.—Length up to 150 mm., width up to 1 mm., segments up to 200. Body long, threadlike. Parapodia with presetal lobe short, rounded, with postsetal lobe longer, tapered (fig. 70*c*). In far posterior region, postsetal lobe becomes elongate, digitiform, erect (fig. 70*d*). Anterior parapodia with simple, limbate, curved setae with long tips (fig. 70*g*). Simple hooded hooks beginning on about setiger 9 (1–17; fig. 70,*h*,*j*). Setae and acicula yellow or pale. Proboscis with maxillae II each with 4–5 teeth; maxillae III and IV each with a single tooth. Color: iridescent, light to dark red, yellowish orange to greenish.

BIOLOGY.—Found at low water burrowing in mud and sand beneath stones, in compact sand mixed more or less with mud, and in sandy mud flats close to the low water mark. Rarely found on pile scrapings. Dredged on bottoms of gravel with shells, mud, compact mixtures of mud and sand, various combinations of mud, sand, gravel, with sponges, shells, amphipod and worm tubes. Common among the sandy tunicate *Amaroccium pellucidum*. Some gelatinous egg masses with large, dull greenish yolky eggs found in the sand (Cuttyhunk Harbor, Mass., June 16, 1954). Similar large yolky eggs found inside some individuals found in the same area. The gelatinous masses with the eggs and larvae were in the form of spherical masses attached to the surface of the mud; when the flats were covered with water, they waved to-and-fro with the passing currents.

The early development of *Lumbriconereis* sp. from Newport, Rhode Island, described by Fewkes (1883) may refer to this species. The eggs were found in all stages of growth in the months of June, July, and August. Early development took place within the gelatinous egg masses, after which crawling larvae emerged.

MATERIAL EXAMINED.—Maine (Muscongus Bay near Hog Island, 3 fathoms; Ebenecook Harbor, Southport Island, 3 fathoms; north end Long Ledge, Sheepscot River, 3 fathoms), New Hampshire (Portsmouth Harbor, 2 fathoms); Massachusetts (Georges Bank, 37–182 fathoms; Plum Island; Barnstable and Wellfleet on Cape Cod, Massachusetts and Cape Cod Bays, Vineyard Sound); Florida (Seahorse Key).

DISTRIBUTION.—Maine to off Chesapeake Bay, Gulf of Mexico. Low water to 182 fathoms.

Lumbrineris impatiens (Claparède, 1868)

FIGURE 67*j*

Lumbriconereis maculata Treadwell, 1901b, p. 198, figs. 42–44.

Lumbriconereis near *assimilis* McIntosh, 1903, p. 158, pl. 13, figs. 42–43.

Lumbriconereis impatiens Fauvel, 1923, p. 429, fig. 171,*a–i;* 1933, p. 38; 1953, p. 267, fig. 134,*a–i;* 1955, p. 8; 1957b, p. 214.—Annenkova, 1937, p. 167; 1938, p. 168.—Støp-Bowitz, 1948a, p. 65.—Wesenberg-Lund, 1949, p. 316;

1950a, p. 27; 1950b, p. 70; 1951, p. 56; 1953, p. 53.—Uschakov, 1955, p. 242, fig. 74.—Fauvel and Rullier, 1959, p. 947.
Lumbrineris impatiens Hartman, 1945, p. 26.
Lumbrineris treadwelli Hartman, 1956, pp. 253, 268, 288.
Lumbrinereis impatiens Clark, 1960, p. 23.

DESCRIPTION.—Length up to 400 mm., width up to 5 mm. Parapodia with presetal lobe short, rounded, with postsetal lobe longer, conical in anterior region, becoming somewhat cirriform and erect in middle and posterior regions. Anterior parapodia with simple arched limbate capillary setae and simple hooded hooks beginning on setigers 1–5. Simple hooks in anterior region with long limbate region (appear as worn or incompletely formed limbate setae), gradually becoming shorter in middle and posterior regions. Acicula and setae yellow or pale. Proboscis with maxillae II with 4–5 teeth; maxillae III each with 2 teeth; maxillae IV each with a single tooth. Color: iridescent, pale pink.

BIOLOGY.—Dredged on bottoms of ooze, mud, and mud mixed with sand or gravel.

MATERIAL EXAMINED.—Off Newfoundland (44°23′ N., 61°22′ W.) to off Florida (28°36′ N., 85°33′ W.), numerous *Albatross* stations, 47 to 1,290 fathoms.

DISTRIBUTION.—A cosmopolitan species. Greenland, Iceland, Great Britain to France, Mediterranean, Adriatic, Gulf of St. Lawrence to Florida, West Indies, Gulf of Mexico, Red Sea, Persian Gulf, Iranian Gulf, Indian Ocean, West and Southwest Africa, north Japan Sea to Japan, Indochina, southern California. Low water to 1,290 fathoms.

Genus *Ninoë* Kinberg, 1865

Type (monotypy): *Ninoë chilensis* Kinberg, 1865. Contains only one New England species.

Ninoë nigripes Verrill, 1873a

FIGURE 68,*a–g*

Ninoë nigripes Verrill and Smith, 1874, p. 301.—Verrill, *in* Smith, Harger, and Verrill, 1874, p. 40, pl. 5, fig. 3.—Verrill, 1881, pp. 301, 304, 308, 311.—Webster and Benedict, 1884, p. 720; 1887, p. 724.—Sumner, Osburn, and Cole, 1913, p. 623.—Procter, 1933, p. 140.—Hartman, 1942b, p. 53, figs. 94–97; 1944a, p. 340, pl. 17, fig. 9.—Berkeley and Berkeley, 1954, p. 460.—Stickney, 1959, p. 15.
Ninoë kinbergi Ehlers, 1887, p. 105, pl. 32, figs. 1–9.—McIntosh, 1903, pp. 143, 159, pl. 10, fig. 25, pl. 12, figs. 26–28, text-figs. 7–8.
Ninoë falklandica Monro, 1936, p. 156, fig. 28,*a–l*.—Wesenberg-Lund, 1962, p.116.
Ninoë nigripes gracilis Hartman, 1951, p. 61, figs. 1–2.

DESCRIPTION.—Length up to 100 mm., width up to 4 mm., segments up to 150. Body elongate, slender, stouter anteriorly, tapering posteriorly. Prostomium (fig. 68*a*) bluntly to sharply conical, with posterior median notch (notch is bordered by 2 short translucent areas or nuchal organs), without eyes. Parapodia with presetal lobe short, rounded, with digitiform postsetal lobe in anterior region, diminishing in size and length in postbranchial region. With digitiform branchiae formed below the postsetal lobe, beginning on setigers 2–4 as a single lobe, increasing gradually in number of lobes up to about setiger 10, diminishing in number of lobes at about setiger 25 and disappearing on about setiger 26 (at setiger 9 in very small specimens, to setiger 32 in large specimens). Branchiae up to 1 to 7 lobes, palmately digitiform below the digitiform postsetal lobe (fig. 68*b*). Parapodia with vertical fan-shaped tuft of simple limbate pointed setae (fig. 68*c*) and simple hooded crotchets. Crotchets long winged in anterior region (fig. 68*d*), becoming short winged in middle and posterior regions (fig. 68*e*). Setae dark at base, pale distally. Acicula black. Pygidium with two short ventral anal cirri.

Proboscis with mandibles delicate, white, calcareous, with long slender basal pieces and flaring distally (fig. 68*f*). Maxillae I slender, hooked, with short broad maxillary carriers; maxillae II each with 6–8 teeth; maxillae III and IV each with a single tooth (larger distal fang with minute denticles or frayed edge more proximally, fig. 68*g*). Color: iridescent, flesh or tan; may have white dotted areas forming wide transverse bands; parapodia dark due to black acicula and dark bases of setae; branchiae bright red, with red dorsal and ventral longitudinal blood vessels.

BIOLOGY.—Found at low water in mud. Dredged on bottoms of soft or sticky mud, sandy mud, silty clay and fine sand, mud mixed with gravel, shells, and worm and amphipod tubes. One specimen found in the oceanographic fouling studies in the New England region. Form tubes of mucus mixed with mud and sand. May form mucous tubes in the dishes in the laboratory. Males filled with white sperm masses and females with large orange yolky eggs (about 160–190μ in diameter) found in the Cape Cod Bay region during June, July, and August, as well as numerous very small specimens. Among the specimens collected in Massachusetts Bay by the U.S. Bureau of Fisheries (Location 232, September 24, 1878), fertilized eggs were present among the parapodia in the branchial region. The yolky eggs were being extruded from large pores below the parapodia.

MATERIAL EXAMINED.—Numerous specimens from Gulf of St. Lawrence (Gaspé Bay, 3–4 fathoms), New Brunswick (Miramichi estuary), Nova Scotia, Maine (St. Croix River, Red Beach, low water; north end Long Ledge, Sheepscot River, 3 fathoms; Ebenecock Harbor, Southport Island), Massachusetts (Georges Bank, 32–86 fathoms, Cape Cod Bay, Nantucket Sound, Buzzards Bay, Vineyard Sound), Rhode Island, Long Island Sound, Gulf of Mexico, low water to 640 fathoms.

DISTRIBUTION.—Gulf of St. Lawrence to Florida, Gulf of Mexico, off northwest Spain, Chile, Antarctic (off South America). Low water to 640 fathoms.

Family Arabellidae

Body elongate, cylindrical, of nearly uniform width, attenuated slightly anteriorly and more so posteriorly. Prostomium (figs. 71*a*, 72,*a*,*b*) reduced to a simple, conical or flattened spatulate lobe, without appendages, with or without eyespots on posterior margin, without buccal cushions or palps visible ventrally. First 2 segments apodous, distinct (not fused ventrally forming a lower lip). Parapodia (figs. 71,*b*,*f*; 72,*c*,*d*) essentially uniramous. Notopodia may be represented by minute papillar lobe (sometimes referred to as reduced dorsal cirrus) with embedded notoacicula. Neuropodia with simple limbate setae, with or without projecting thick acicular setae or acicula (without hooded hooks as in Lumbrineridae). Without dorsal and ventral cirri. Without branchiae. Pygidium with 2–4 short anal cirri.

Proboscis eversible, with elaborate dark chitinized jaw pieces, consisting of a pair of ventral flat plates, the mandibles (may be absent) and 4–5 pairs of more dorsal maxillae disposed in parallel rows, with pair of long slender maxillary carriers as well as a shorter median unpaired piece (figs. 71,*d*,*e*,*g*; 72,*g*,*h*).

The arabellids are essentially burrowing, predaceous, carnivorous. They burrow readily but rather slowly in sand or mud. They secrete a good deal of mucus, which serves probably to lubricate the burrow. Some are endoparasitic in other worms—eunicids, onuphids, syllids, terebellids, echiuroids (*Bonellia*). They appear to be parasitic from a very young stage up to advanced stages, apparently becoming sexually mature after leaving the host. Although maintaining a marked similarity to their free-living relatives, they may show modifications associated with their parasitic existence, such as reduction in setae, jaw parts, pigmentation, and mucous glands (Pettibone, 1957b).

Key to the New England Genera of Arabellidae

1. Free living 2
   Endoparasitic in other polychaetes. With stout acicula or acicular setae which sometimes project from parapodial lobes (fig. 71*f*) 4
2. Parapodia without heavy projecting acicular setae (fig. 71*b*). Prostomium usually with 4 eyes on posterior margin (fig. 71*a*). Maxillae I and II asymmetrical (fig. 71*e*); mandibles well developed, wing shaped (fig. 71*d*). **Arabella** (p. 269)
   Parapodia provided with heavy projecting acicular setae or acicula (figs. 72,*c*,*d*; 73*b*) 3

3. Prostomium spatulate, flattened dorsoventrally, without eyes (fig. 72*a*). Maxillae symmetrical; maxillae I strongly falcate, with or without teeth at base (fig. 72*h*); mandibles absent or poorly developed, wedge shaped (fig. 72*g*) . . . . **Drilonereis** (p. 271)
   Prostomium conical, only slightly flattened ventrally, usually with 4 eyes on posterior margin (fig. 73*a*). Maxillae I and II asymmetrical; maxillae I dentate along entire length or only slightly falcate distally (fig. 73,*f–g,i*). **Notocirrus** (p. 275)
4. Prostomium flattened, spatulate, without eyes. Mandibles absent. **Drilonereis** (p. 271)
   Prostomium conical, only slightly flattened, with 4 eyes on posterior margin; mandibles well developed, wing shaped . . . . **Notocirrus** (p. 275)

Genus *Arabella* Grube, 1850

Type (original designation): *Arabella quadristriata* (Grube, 1840); =*Arabella iricolor* (Montagu, 1804). Contains only one New England species.

Arabella iricolor (Montagu, 1804)

FIGURE 71,*a–e*

Lumbriconereis opalina Verrill and Smith, 1874, pp. 26, 38, 48, 70, 77, 83, 103, 116, 134, 140, 174, 300, pl. 13, figs. 69–70.

Arabella opalina Webster, 1879, p. 242; 1884, p. 321; 1886, p. 145.—Verrill, 1881, pp. 291, 301, 317, 322, pl. 4, fig. 4.—Webster and Benedict, 1884, p. 721.—Andrews, 1891a, p. 288.—Sumner, Osburn, and Cole, 1913, p. 622.—Treadwell, *in* Cowles, 1930, p. 342.

Aracoda semimaculata Moore, 1911, p. 295, pl. 20, figs. 143–149.

Arabella iricolor Fauvel, 1923, p. 438, fig. 175,*a–h;* 1933, p. 37; 1953, p. 274, fig. 140,*a–h;* 1955, p. 8; 1957b, p. 214.—Annenkova, 1938, p. 169.—Hartman, 1942b, p. 55; 1944d, p. 173; 1945, p. 27; 1951, p. 63; 1956, pp. 247, 288.—Berkeley and Berkeley, 1948, p. 97, figs. 147–149.—Hartman and Reish, 1950, p. 25.—Uschakov, 1955, p. 244, fig. 81.—Rioja, 1958, p. 269.—Fauvel and Rullier, 1959, p. 950.—Clark, 1960, p. 24.—Wesenberg-Lund, 1962, p. 118.

Arabella iricolor var. *caerulea* Day, 1953, p. 439, fig. 6*n*; 1960, p. 363.

DESCRIPTION.—Length up to 600 mm., width up to 5 mm., segments up to 500. Prostomium (fig. 71*a*) bluntly conical, flattened ventrally, arched dorsally, with 4 small black eyes in nearly transverse line on posterior dorsal margin (prostomium may be contracted into buccal segment, thus hiding the eyes). Eyes subequal or either outer or inner pairs may be slightly larger. Parapodia (fig. 71*b*) with short rounded presetal lobe, with longer digitiform postsetal lobe, becoming longer and more or less erect in middle and posterior segments. Setae simple, limbate, curved, with fine tips; some strongly curved and denticled at base of the winged plate (fig. 71*c*). Acicula yellow, numerous, often terminating in capillary tips which may surpass the setigerous lobe. Anal cirri 2 to 4, short (may be pair of short dorsal ones and pair of short ventral knobs).

Proboscis with a pair of broad, black, toothed mandibles, articulated medially (fig. 71*d*). Maxillae with very long, filamentous, separate maxillary carriers and an unpaired piece. Maxillae I large, hooked, denticled at base, right and left pieces slightly asymmetrical with 8–11 teeth; maxillae II distinctly asymmetrical, left one smaller, with 6–8 teeth, right one larger with 12–14 teeth; maxillae III and IV similar, each with denticled margin with 4–7 teeth and 2 divergent supporting wings; maxillae V each with a single tooth (fig. 71*e*; V on one side may be absent, according to Moore). Color: reddish,

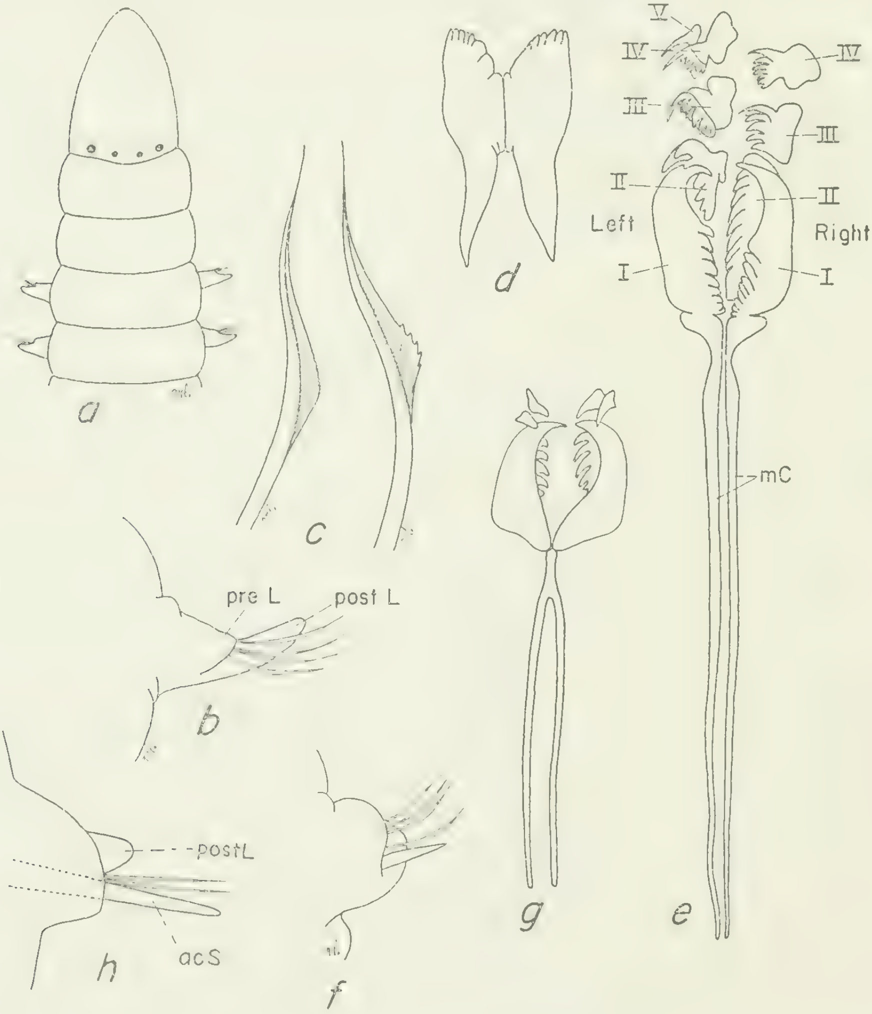

Figure 71.—Arabellidae, *a–e*, *Arabella iricolor* (*d–e*, Moore, MS.): *a*, dorsal view anterior end; *b*, middle parapodium, anterior view; *c*, limbate setae from middle parapodium; *d*, mandibles, from above; *e*, maxillae, under slight pressure so that the accessory plates are turned to one side. *f–g*, *Drilonereis caulleryi*: *f*, middle parapodium, anterior view; *g*, maxillae, dorsal view. *h*, *Drilonereis magna*, parapodium (after Webster and Benedict, 1887).

brownish, reddish yellow, reddish and greenish with brilliant metallic or opalescent iridescence.

Biology.—Found at low water burrowing in sand and muddy sand, in sand under rocks and rocky crevices, in oyster and mussel beds, and in roots of eelgrass (*Zostera*), and holdfasts of *Laminaria*. Some small specimens found among pile scrapings. Dredged in bays and sounds on bottoms of sand, mud, gravel, rocks, with shells, among bryozoan nodules, with compound ascidians (as the sandy *Amaroccium pellucidum*). Form no tubes but burrow readily and deeply, encased in a thick coat of mucus, which they secrete in abundance. Hard and wiry and may contract into close spiral coils. Breeding occurs throughout the summer in the Woods Hole region but ripe specimens are rare (Moore, ms.). Regeneration occurs with great facility and examples with abnormalities of annulation, probably in part the results of renewal, are common (Moore, ms.).

Material examined.—Numerous specimens from Massachusetts (Cape Cod, Woods Hole region, Vineyard Sound, Nantucket Sound, Buzzards Bay), Rhode Island, Connecticut, Virginia (Chincoteague Bay near Robins Marsh; Chesapeake Bay), South Carolina (Calibogue Sound; Skull Creek), Gulf of Mexico.

Distribution.—Cosmopolitan in temperate and tropical regions. English Channel to France, Mediterranean, Adriatic, Massachusetts to Florida, Bermuda, Gulf of Mexico, West Indies, off Colombia and Venezuela, Vancouver Island to California, Mexico, north Japan Sea to Japan, China, Persian Gulf, Red Sea, Indian Ocean, Straits of Magellan, West and South Africa. Low water to 46 fathoms.

Genus *Drilonereis* Claparède, 1870

Type (original designation): *Drilonereis filum* (Claparède, 1868).

Both free-living species represented have the prostomium conical, spatulate, bluntly rounded anteriorly, greatly flattened dorsoventrally, without eyes. Proboscis with maxillae I heavy, strongly hooked, resembling ice tongs, toothed at the base, with a pair of long slender rodlike maxillary carriers and a shorter oval unpaired piece. Maxillae II each with about 8 teeth; maxillae III each with 1 main fang and 1–3 smaller ones; maxillae IV each with a single fang (fig. 72*h*).

Key to the New England Species of *Drilonereis*

1. Free living 2
   Parasitic in onuphids . . . . **D. caulleryi**
2. Parapodia small, inconspicuous on anterior setigers (fig. 72,*a*,*b*); in far posterior region, parapodia distinctly bilabiate (fig. 72*d*) . . . . . . **D. longa**
   Parapodia prominent from first setiger on, similar throughout length of body (fig. 71*h*) . . . . **D. magna**

Drilonereis longa **Webster, 1879**

FIGURE 72

Drilonereis longa Webster, 1879, p. 240, pl. 7, figs. 84–88.—Webster and Benedict, 1884, p. 721.—Andrews, 1891a, p. 238.—Sumner, Osburn, and Cole, 1913, p. 622.—Hartman, 1944a, p. 340, pl. 17, fig. 8; 1944d, p. 178; 1945, p. 51.
Laranda longa McIntosh, 1885, p. 237, figs.

DESCRIPTION.—Length up to 710 mm., width up to 1.5 mm., segments up to 1,000. Parapodia inconspicuous on first few setigerous segments (fig. 72,*a*,*b*); they form a low mound on about the first 30 setigers, becoming short, conical on about setigers 30–50 (fig.

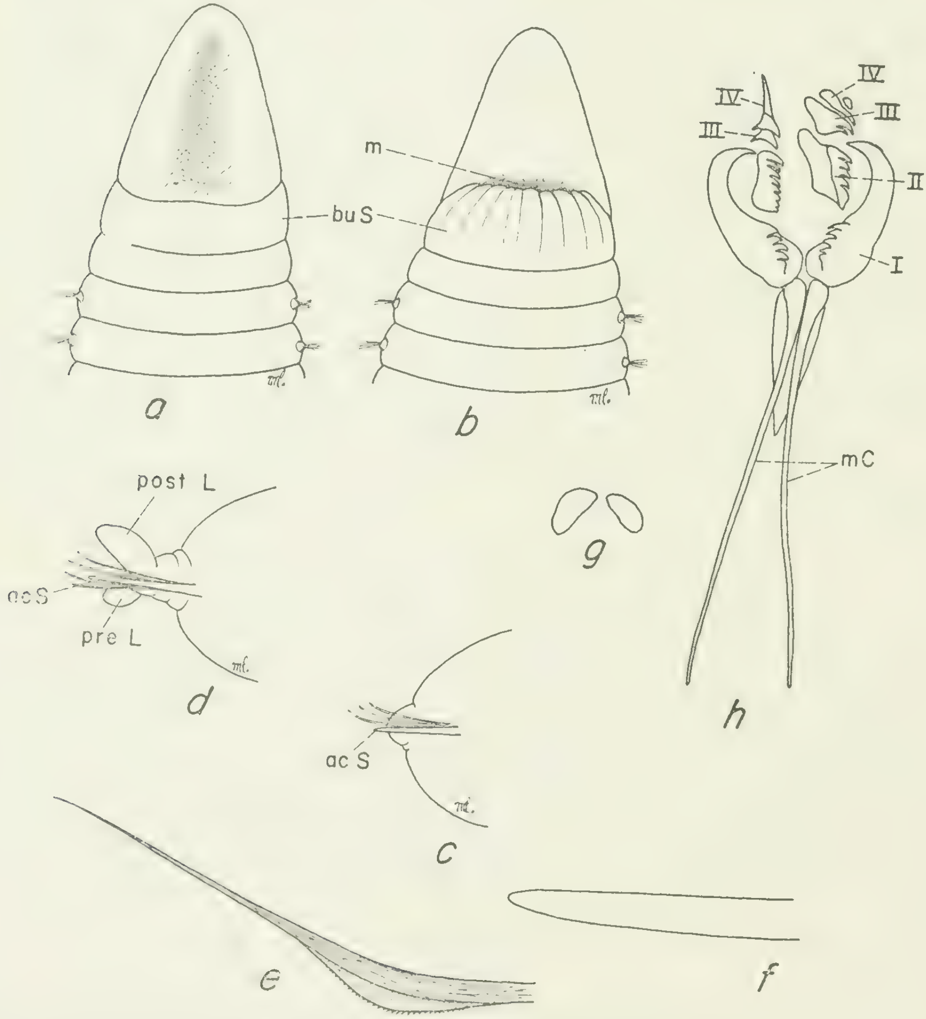

FIGURE 72.—Arabellidae, *Drilonereis longa* (*e–h*, after Moore, MS.): *a*, dorsal view anterior end; *b*, ventral view anterior end; *c*, parapodium from anterior region (about setiger 35), posterior view; *d*, parapodium from posterior region, posterior view; *e*, limbate seta from setiger 23; *f*, acicular seta or spine from setiger 23; *g*, mandibles; *h*, maxillae.

72*c*). After about setiger 50 there is a short rounded presetal lobe and a longer digitiform postsetal lobe which gradually gets longer. In the posterior region (about the posterior third), the presetal lobe gets longer gradually and the parapodial lobe becomes distinctly bilabiate (fig. 72*d*). Parapodia with a few simple limbate setae (fig. 72*e*) and a single stout projecting acicular seta or spine (fig. 72*f*). Setae and acicula pale. Anal cirri 4, short, subequal, bulbous.

Proboscis usually with a pair of widely separated, short, wedge-shaped mandibles (fig. 72*g*), which are probably degenerate, as they are variable in shape and size and may be strongly asymmetrical. Webster found that 1 or both mandibles may be missing. Four pairs of maxillae (fig. 72*h*) present. Color: iridescent, bright to pinkish red.

BIOLOGY.—Found at low water, burrowing in sand, mud, and muddy sand with rubble. Dredged on bottoms of fine sand, silty clay, mud, with worm tubes or fine gravel. Become coiled and tangled in knots and secrete a good deal of mucus. This species, which ramifies through the sand as living threads of great delicacy, is remarkable for the tenuity to which it can be stretched (Moore, MS.).

MATERIAL EXAMINED.—Numerous specimens from Massachusetts (Georges Bank, 44–50 fathoms, R. Wigley; Barnstable, Wellfleet on Cape Cod, Woods Hole region, Buzzards Bay, Nantucket Sound, Vineyard Sound), Rhode Island (Greenwich Bay, A. P. Stickney), New Jersey (Raritan Bay), Long Island Sound, North Carolina (Beaufort), South Carolina (Coosans River, *Fish Hawk*, 1891), Georgia, (Sapelo Island).

DISTRIBUTION.—Massachusetts to Georgia, West Indies. Low water to 1,340 fathoms.

Drilonereis magna **Webster and Benedict, 1887**

FIGURE 71*h*

Drilonereis magna Webster and Benedict, 1887, p. 725, pl. 4, figs. 60–63.—Not Hartman, 1945, p. 27; 1951, p. 63.

Drilonereis falcata Moore, 1911, p. 298, pl. 20, figs. 150–154.—Hartman, 1944d, p. 179; 1960b, p. 106.—Day, 1960, p. 364.

Drilonereis cylindrica Hartman, 1951, p. 64, pl. 16, figs. 3–5.

DESCRIPTION.—Length up to 200 mm., width up to 2.5 mm., segments up to 300. Parapodia short and stout throughout, with a short bluntly rounded presetal lobe and a longer digitiform postsetal lobe, with simple limbate setae and 1–2 stout projecting acicular setae. Setae and acicula yellow to pale. Anal cirri 2 to 4, short. Proboscis with a pair of black subtriangular to oval mandibles, with 4–5 pairs of maxillary pieces. Maxillae V each with a single fang, may or may not be present.

BIOLOGY.—Found at low water in mud and fine to coarse sand. Dredged on bottoms of gravel, gravel with sand or mud. Found in the stomach of haddock (Georges Bank, 1955, R. Wigley).

MATERIAL EXAMINED.—Off Newfoundland (*Albatross* III, 44°19′ N., 67°43′ W., 1953, R. Wigley), Nova Scotia (*Albatross* Station 2521, 42°30′ N., 65°02′ W., 65 fathoms), Maine (type specimen from Eastport, including slides with jaw pieces), Massachusetts (Georges Bank, 40–600 fathoms, R. Wigley; south Martha's Vineyard, 27 fathoms; Vineyard Sound, 34 fathoms), North Carolina (Beaufort), South Carolina (Coosans River, *Fish Hawk*, 1891), Gulf of Mexico (Seahorse Key, Florida; off Yucatan), Washington (Callam Bay, Strait of Juan de Fuca, 107 fathoms), California (Monterey Bay, Type of *D. falcata*).

DISTRIBUTION.—Off Newfoundland to South Carolina, Gulf of Mexico, Washington, southern California to western Mexico, South Africa. Low water to 600 fathoms.

Drilonereis caulleryi Pettibone, 1957b

FIGURE 71,*f–g*

Drilonereis caulleryi Pettibone, 1957b, p. 179, fig. 2.

DESCRIPTION.—Length up to 110 mm., width up to 1 mm., segments up to 400 or more. Prostomium conical, flattened dorsoventrally, without eyes. Parapodia similar along length of body, unequally bilobed, with shorter, rounded setal lobe and longer, thick, digitiform postsetal lobe, with setae of two kinds: up to 5 limbate setae and single stout yellowish acicular seta (fig. 71*f*; in smaller specimens, setae may not project from parapodial lobe). Proboscis without mandibles, with 4 pairs maxillae supported by pair of filiform maxillary carriers and shorter unpaired piece. Maxillae I stout, falcate, forcepslike; maxillae II each with 4 teeth; maxillae III and IV each with a single large, thornlike tooth (fig. 71*g*).

BIOLOGY.—Found living parasitically in anterior fragments of *Onuphis conchylega* Sars, a single parasite per host. They enter the host evidently at an early stage and may become so large that they partly protrude from the host. The hosts, living in flattened parchmentlike tubes encrusted with stones and shells, are dredged on bottoms of mud, fine sand, and shells.

MATERIAL EXAMINED.—Types from off Massachusetts to off Virginia.

DISTRIBUTION.—North Atlantic, off Massachusetts to off Virginia. In 101 to 317 fathoms.

Genus *Notocirrus* Schmarda, 1861; emend. Ehlers, 1868

Type (designated by Ehlers, 1868): *Notocirrus chilensis Schmarda*, 1861. Contains only one New England species.

Notocirrus spiniferus (Moore, 1906b)

FIGURE 73

Arabella spinifera Moore, 1906b, p. 501, pl. 19, figs. 1–7.
Notocirrus spiniferus Pettibone, 1957b, p. 181, figs. 3–5.

DESCRIPTION.—Length up to more than 110 mm., width up to 4 mm., segments up to more than 220. Prostomium subconical,

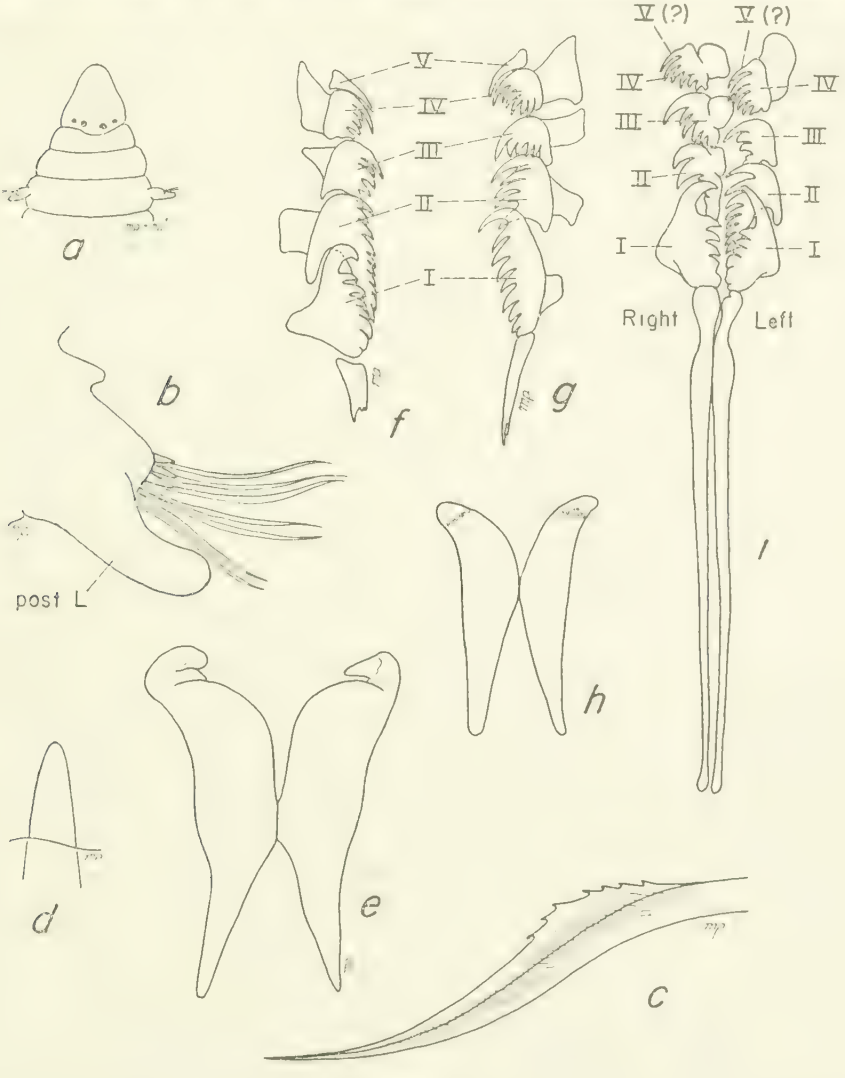

FIGURE 73.—Arabellidae, *Notocirrus spiniferus* (*h–i*, after Moore, MS.): *a*, dorsal view anterior end; *b*, parapodium from setiger 10, posterior view; *c*, limbate seta; *d*, tip of stout projecting acicular seta; *e*, mandibles, ventral view; *f*, left maxillae, dorsal view; *g*, right maxillae, dorsal view; *h*, mandibles, dorsal view; *i*, maxillae and maxillary carriers, dorsal view.

rounded anteriorly, slightly flattened dorsoventrally, with 4 eyes (2 reported for type) in transverse row on posterior border (fig. 73*a*). Parapodia (fig. 73*b*) with small but distinct notopodia with embedded acicula, with prominent neuropodia. Neuropodia with short rounded setal lobe and elongated cirriform postsetal lobe containing a vascular loop; 1–3 stout amber-colored projecting acicular setae (fig. 73*d*) and simple curved limbate setae with acute tips and finely denticled margins (fig. 73*c*).

Proboscis with mandibles dark, wing-shaped (fig. 73,*e*,*h*). Maxillae (fig. 73,*f*,*g*,*i*) with pair long slender maxillary carriers and rather short unpaired piece (latter not shown in figure). Maxillae I and II asymmetrical. Right maxilla I longer than left, with up to 10 denticles along length of inner border and without distal hook; left maxilla I with up to 6 basal teeth and distinct distal hook (Moore, in figure for type, showed distal hooks on both first maxillae and fewer teeth, fig. 73*i*). Left maxilla II much larger than right maxilla II, completely overlapping left maxilla I and extending down to maxillary carriers, with up to 12–13 teeth; right maxilla II partially overlapping right maxilla I, with up to 8–10 teeth. Maxillae III each with six teeth. Maxillae IV each with 5 teeth. Maxillae V each with a single tooth (may appear to blend in with maxillae IV).

BIOLOGY.—Found at low water and dredged on bottoms of sand with shells. Stiff and wiry. Young stages of this species thought to live parasitically in the body cavity of *Diopatra cuprea* (Pettibone, 1957b). How and at what stages they enter and leave the host are unknown. Found living parasitically from a small stage of 7 segments up to elongated worms of up to 200 segments and 5 mm. long (Allen, 1952). More than 50 parasites found in a single host.

MATERIAL EXAMINED.—Free-living specimens from Massachusetts (Buzzards Bay, H. Sanders; Nantucket Sound, 8 fathoms, T. Shafer, numerous specimens), Maryland (Isle of Wight Bay above Ocean City, S. McDowell), Virginia (off Cape Henry, *Fish Hawk* Station 8838, 9 fathoms, 1920), North Carolina (Beaufort, E. Cole). Parasites in *Diopatra cuprea* from Massachusetts (Hadley Harbor, Nonamesset Island, J. Allen; Nantucket Sound, 8 fathoms).

DISTRIBUTION.—Massachusetts to North Carolina. Low water to 9 fathoms.

Family Orbiniidae (=Ariciidae)

Body long, slender, vermiform, with moderate number or very numerous segments (60–300); segments often biannulate or triannulate. Parapodia biramous, supported by acicula. Body divided into 2 weakly to sharply separable regions: (1) Shorter anterior thoracic region, more or less flattened dorsoventrally and enlarged, firm, muscular, attenuated anteriorly, with biramous parapodia which are lateral in position; neuropodia cushionlike, with more or less developed postsetal lobes and several vertical rows of setae or crotchets; notopodia with conical or cirriform postsetal lobes (sometimes referred to as dorsal cirri), with fan-shaped bundles of setae; (2) much longer posterior abdominal region, semicylindrical, tapering posteriorly, with parapodia shifted dorsally; neuropodia bilobed, with few long setae; notopodia with ligulate vascular postsetal lobes, with bundles of long setae. Branchiae dorsal, medial to notopodia, simple (rarely branched), erect, lanceolate or straplike, strongly ciliated on lateral margins, a pair on all but anterior segments (lacking on anterior 2–30 or so segments). The elongated branchiae and parapodial lobes in the abdominal region give an exceedingly ragged brushlike aspect to the middle and posterior parts of the body. The abdominal region is often extremely fragile. With or without subpodal lateral papillae or accessory flangelike lobes (sometimes referred to as ventral cirri). With or without subpodal ventral or stomach papillae or ventral fringe. Setae all simple, of various kinds: capillary, crenulate or spinous setae; forked setae with frayed inner prongs (broken spinous crenulate setae?; fig. 74*b*); slender crotchets (worn spinous setae?); stout crotchets (fig. 74*c*); hastate spear-shaped or lanceolate spines. The setae and crotchets may be variously ornamented with cross ridges, appearing to be excavated or camerated or with fine transverse rows of teeth.

Prostomium conical, more or less acutely pointed, globular, or broad, spatulate, without appendages, with or without 2 small eyes, with a pair of inconspicuous ciliated slitlike nuchal organs (when everted, may be mistaken for minute antennae). First 1 or 2 segments apodous and achaetous, without tentacular cirri. Pygidium simple or lobed, with 2 to 4 anal cirri. Sometimes with interramal cirri (fig. 76,*f*,*g*), interramal cushionlike ciliated lateral organs, or metameric statocysts. Proboscis eversible, unarmed, simple saclike or voluminous, weakly lobulated to much branched soft sac (fig. 76*d*).

The orbiniids are small to moderately large in size, occurring from the littoral zone down to considerable depths. Aided by the protrusible proboscis, they burrow in sand or mud containing organic debris, upon which they feed. They live upon small organisms and often ingest much foreign matter, their intestines frequently containing sand and debris of shells, foraminiferans, etc. Often very coarse sand forms the chief contents of the digestive tract. They are freely moving in habit and construct no tube. When removed from their burrows, they usually throw themselves into close spiral coils. Swimming is accomplished with an abrupt opening and closing of the coil. They are noted for their fragileness. They are usually pale orange to yellowish orange, orange red, with bright red branchiae and postsetal lobes, due to the red blood within.

Judging from the few species of orbiniids that have been studied in regard to their reproduction, yolky eggs may be spawned free or fertilized eggs laid in irregular ribbon-shaped clusters, cylindrical or pear-shaped gelatinous masses attached to the sand where the adults live. They may have a very short swimming stage or pelagic stages may be lacking. In the larvae, large ciliated branchiae appear early, first appearing on segments 7–12 (setigers 5–10; Thorson, 1946; Okuda, 1946; Horn and Bookhout, 1950, Anderson, 1959).

The orbiniids are intermediate between the errant and sedentary types of polychaetes.

Key to the New England Genera of Orbiniidae

1. Prostomium suboval (fig. 74*a*) or truncate, loaf-shaped . . **Naineris** (p. 278)
   Prostomium conical (fig. 76,*a,c*) 2
2. Postsetal neuropodial lobes of thoracic segments fimbriated, with vertical rows of postsetal papillae or podal fringe (more than 3 papillae, fig. 75,*a–c*) . . . . **Orbinia** (p. 280)
   Postsetal neuropodial lobes of thoracic segments not fimbriated, with 0–3 papillae (figs. 74*e*; 76*e*). . . . . **Scoloplos** (p. 286)

Genus *Naineris* Blainville, 1828; emend. Pettibone, 1957

Naidonereis Malmgren, 1867.
Nainereis Mesnil and Caullery, 1898.

Type (monotypy): *Naineris quadricuspida* (Fabricius, 1780). Contains only one New England species.

Naineris quadricuspida (Fabricius, 1780)

Figure 74,*a–c*

Naidonereis quadricuspida Webster and Benedict, 1887, p. 738, pl. 6, figs. 90–92.—Whiteaves, 1901, p. 79.

Nainereis quadricuspida Fauvel, 1927, p. 23, fig. 8,*a–g*.—Procter, 1933, p. 140.—Annenkova, 1938, p. 171.—Wesenberg-Lund, 1950a, p. 29; 1950b, p. 74; 1951, p. 59; 1953, p. 56.—Uschakov, 1955, p. 260, fig. 87.—Not Berkeley and Berkeley, 1956c, p. 544 (=*N. uncinata* Hartman, 1957, published June 14, 1957;=*N. berkeleyorum* Pettibone, 1957a, published July 29, 1957).

Description.—Length up to 80 mm., width up to 3 mm., segments up to 130. Body elongate, sublinear, slightly flattened anteriorly, tapering gradually posteriorly. Segments uniannulate and biannulate in thoracic region, triannulate in most of abdominal region. Prostomium (fig. 74*a*) subglobular, slightly wider than long, with a pair of minute black eyes near posterior border (visible when living). A single apodous and achaetous tentacular or buccal segment which may appear entire or 2-, 3-, or 4-ringed (perhaps representing more than 1 segment).

Branchiae begin usually on setiger 5 (4–6), continuing along rest of body, at first short, triangular, then becoming broad, lanceolate, longer than the parapodial lobes, with margins densely ciliated up to near the tip. Thoracic region consisting of about 13 setigers (11–17), with parapodia lateral. Notopodia dorsolateral, with a bundle of long, crenulate capillary setae (may be few forked setae, fig. 74*b*), with digitiform postsetal lobe. Neuropodia lateral, cushionlike, with fleshy postsetal plate with a small conical process in the middle of the plate, with about 5 vertical rows of short stout crotchets, with a

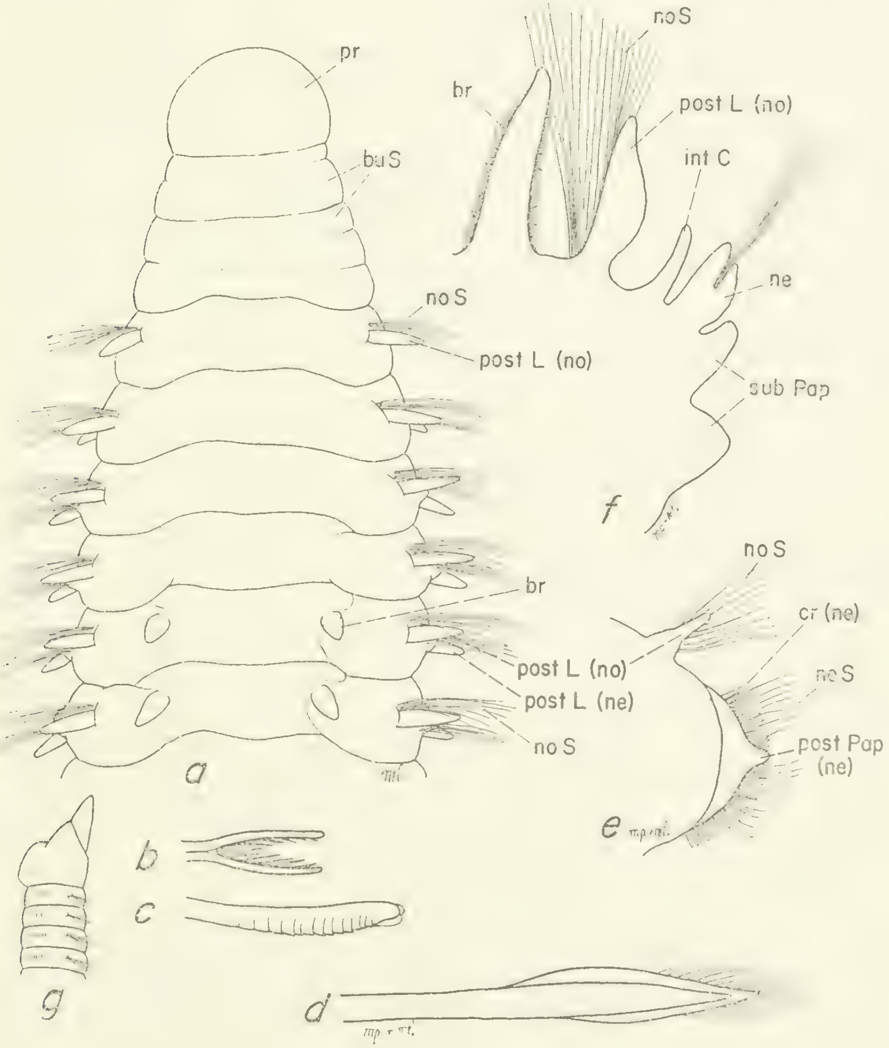

FIGURE 74.—Orbiniidae, *a–c*, *Naineris quadricuspida* (*b–c*, after Moore, MS.): *a*, dorsal view anterior end; *b*, tip of forked notoseta; *c*, thoracic neuropodial crotchet. *d*, *Scoloplos schmitti*, neuropodial spine from setiger 2. *e–f*, *Scoloplos riseri*: *e*, right thoracic parapodium from setiger 6, posterior view; *f*, tenth abdominal parapodium, posterior view. *g*, *Scoloplos acutus*, lateral view anterior end with proboscis partially extended (after Procter, 1933).

posterior row of longer capillary setae similar to the notosetae. Crotchets crenulate, notched or hooded at the tip (fig. 74*c*).

Abdominal region with parapodia directed dorsally. Notopodia with erect digitiform postsetal lobes and notosetae similar to the thoracic region. Neuropodia bilobed, lower lip longer and thicker than the upper lip, with few long slender crenulate capillary setae and few acicula with curved projecting tips. Pygidium with 4 bluntly rounded lobes, dorsal, ventral, and lateral, with four short cylindrical anal cirri alternating with the lobes. Proboscis simple, saclike (fully extended?). Color: yellowish, pale pink, rose gray or nearly colorless, with red branchiae and middorsal blood vessel.

BIOLOGY.—Found at low water on rocky shores, with algae, in tide pools, on soft bottom under stones, among shells, in sand among byssus threads of mussels (as *Modiolus modiolus*) under encrusting calcareous algae (as *Lithothamnion*), in holdfasts of *Laminaria*, in scrapings from pilings among large barnacles. They were found at several stations in the oceanographic fouling studies in the New England area. Dredged on bottoms of mud, sand, gravel, and among the sandy tunicate *Amaroecium pellucidum*. In Iceland, females with ripe yellow eggs were found in spring and autumn, the spawning season lasting nearly half a year (Saemundsson, 1918). In Maine, females with large yolky eggs were found in April (Sea Point, April 3, 1954).

MATERIAL EXAMINED.—Gulf of St. Lawrence (St. Lawrence estuary, Bay of Chaleurs, Anticosti Island), Newfoundland, Nova Scotia, New Brunswick (St. Andrews), Maine (Rockland, Gulf of Maine, Boothbay Harbor region, Casco Bay, York, Sea Point near Kittery), New Hampshire (Isles of Shoals), Massachusetts (Georges Bank, 15–47 fathoms, R. Wigley; Cape Cod Bay, vicinity of Nantucket), Alaska (Constantine Harbor, Amchitka Island, 1873, W. H. Dall; Lagoon Reef, St. Paul Island).

DISTRIBUTION.—Widely distributed in the Arctic, north Japan Sea, Alaska, Iceland, Faroes, Shetlands, Norway to France, Gulf of St. Lawrence, Newfoundland to Massachusetts (Cape Cod Bay, Nantucket). Low water to 1,110 fathoms.

Genus *Orbinia* Quatrefages, 1866

Aricia Savigny, 1820, preoccupied by R. L. (1817, Lepidoptera); type (monotypy): *Aricia sertulata* Savigny, 1820.

Type (original designation): *Orbinia sertulata* (Savigny, 1820).

Subgenus *Phylo* Kinberg, 1866; emend. Hartman, 1949

Type (monotypy): *Phylo felix* Kinberg, 1866.

All the species represented have the body divided into anterior thoracic and posterior abdominal regions. Thoracic region more or less wide and flattened, tapering rather abruptly anteriorly, abdominal region much longer, semicircular in cross section, tapered gradually posteriorly, often fragmenting. Prostomium conical, without appendages, without eyes. Single achaetous tentacular or buccal segment, without tentacular cirri. The buccal segment and first 2 setigerous segments involved in the mouth. Thoracic region consisting of 14–37 setigers. Notopodia with a simple digitiform postsetal lobe (may sometimes be bifurcated in *O. norvegica*), with a radiating bundle of crenulate capillary setae. Neuropodia thick, cushionlike, with a postsetal fringe of papillae, with transverse rows of crotchets (blunt tips) or pseudocrotchets (tips enclosed in pointed sheaths) and crenulate capillary setae.

Abdominal region with parapodia directed dorsally. Notopodia similar to those of thoracic region except they are more elongate, sometimes with few forked setae among the capillary crenulate setae (broken crenulate capillaries?). Neuropodia short, cylindrical, bilobed at tip, with few short acicula and bundle of crenulate capillary setae. Branchiae begin on about setiger 5 (4–6), paired, simple, straplike, ciliated up to near distal tip, becoming long, ligulate in abdominal region.

Key to the New England Subgenera and Species of *Orbinia*

1. With heavy spear-shaped or spikelike spines on some posterior thoracic neuropodia (fig. 75*c*) . . (subgenus Phylo) 2
   Without heavy spines . . (subgenus Orbinia, sensu stricto) 4
2. With subpodal ventral or stomach papillae on some anterior segments (fig. 75*b*) 3
   Without subpodal ventral papillae . . . . **O. (Phylo) norvegica**
3. With interramal cirri on some anterior abdominal segments (fig. 75*f*). **O. (Phylo) michaelseni**
   Without interramal cirri (fig. 75*g*) . . . . **O. (Phylo) kupfferi**
4. With ventral cirri in abdominal parapodia (fig. 75*d*) . . **O. (Orbinia) swani**
   Without ventral cirri . . . . **O. (Orbinia) ornata**

***Orbinia* (*Phylo*) *norvegica* (Sars, 1872)**

Figure 75*c*

Aricia norvegica Sars, 1873, p. 236, pl. 16, figs. 1–8.—Fauvel, 1927, p. 17, fig. 5,*m–p*.—Annenkova, 1937, p. 168; 1938, p. 170.—Wesenberg-Lund, 1950b, p. 75.—Uschakov, 1955, p. 257, fig. 85.—Eliason, 1962, p. 260.

Aricia nuda Moore, 1911, p. 311, pl. 21, figs. 172–176.—Fauvel, 1932a, p. 162, fig. 25.

Phylo norvegica Støp-Bowitz, 1948a, p. 66.

Phylo nudus Hartman, 1957, p. 268; 1960b, p. 108.

Phylo norvegicus Hartman, 1959a, p. 367.—Kirkegaard, 1959, p. 13.

Description.—Length? (more than 20 mm.), width up to 6 mm., segments numerous (more than 40). Thoracic setigers 16–17.

Thoracic neuropodial postsetal lobes with up to 7–15 papillae, with several rows of pseudocrotchets, the tips enclosed in pointed sheaths, with numerous crenulate capillary setae. Posterior few (3–5) thoracic neuropodia with 4–8 stout brown spearlike spines, the spines very short (perhaps broken or enclosed) or protruding some distance, especially the upper one (fig. 75*c*). Abdominal region with neuropodia unequally bilobed, the inner lobe short, rounded, the outer lobe longer, tapered. Without interramal cirri; with thick conical subpodal papilla or ventral cirrus. Without subpodal ventral or stomach papillae in thoracic region. Proboscis a frilled, rosettelike sac.

BIOLOGY.—Dredged on bottoms of sand and mud.

MATERIAL EXAMINED.—Off Massachusetts (41°03′ N., 66°14′ W.) to off Long Island Sound (37°12′ N., 74°20′ W.), *Albatross* Stations, 65–866 fathoms.

DISTRIBUTION.—Greenland, Norway, off Shetlands, North Sea, Mediterranean, West Africa, south of Newfoundland to off Long Island Sound, north Japan Sea, off southern California, off Brazil, Indian Ocean. In 34 to 1,340 fathoms.

***Orbinia (Phylo) michaelseni* (Ehlers, 1897)**

FIGURE 75*f*

Aricia michaelseni Ehlers, 1897, p. 88, pl. 6, figs. 136–140.—? Not Monro, 1930, p. 144, fig. 54.—Not Okuda, 1937b, p. 101.—? Not Berkeley and Berkeley, 1952, p. 96, figs. 194–196.

DESCRIPTION.—Length? (more than 50 mm.), width up to 3 mm., segments over 165. Thoracic setigers about 16 (16–19). Thoracic neuropodial postsetal lobes with up to 9 papillae; anterior thoracic neuropodia with about 4 rows of finely denticled pseudocrotchets (the distal tips enclosed in sheaths tapered to fine tips) or crotchets (blunt tips, sheath may be worn off), with a single row of crenulate capillary setae. Posterior few (3–6) thoracic neuropodia with few crotchets and with 5–6 heavy spines in anterior row, the spines enlarged and grooved distally.

Abdominal region with cirriform interramal cirri, with conical subpodal papilla or ventral cirrus (fig. 75*f*). Subpodal ventral or stomach papillae on about setigers 12–21; where best developed, they form nearly a semicircular ring.

BIOLOGY.—Dredged on bottoms of mud and fine sand.

MATERIAL EXAMINED.—Off Massachusetts (*Albatross* Station 2249, 40°11′ N., 69°52′ W., 53 fathoms).

DISTRIBUTION.—Off Straits of Magellan, off Massachusetts. In 2 to 53 fathoms.

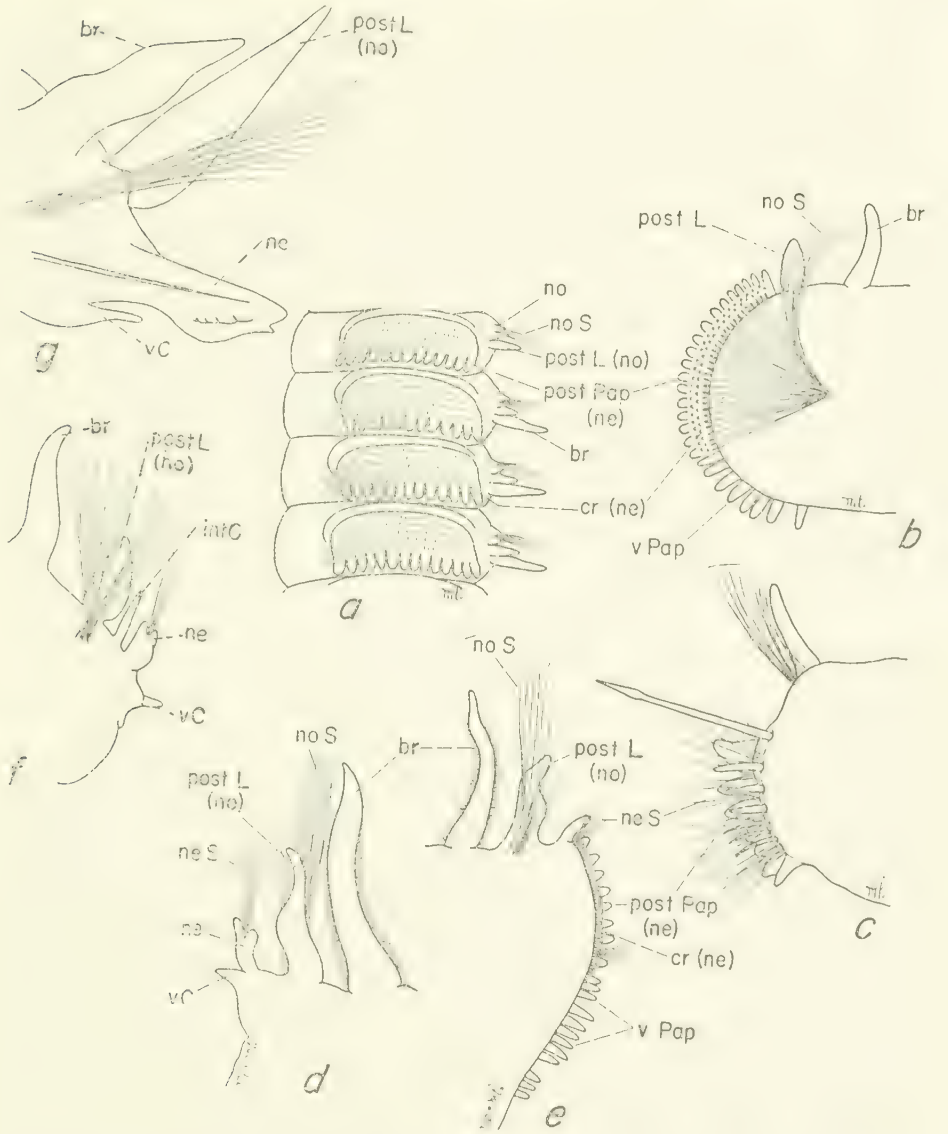
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FIGURE 75.—Orbiniidae, *a–b*, *Orbinia ornata: a*, lateral view setigers 4–7; *b*, thoracic parapodium from setiger 15, anterior view. *c*, *Orbinia norvegica*, posterior thoracic parapodium, anterior view. *d–e*, *Orbinia swani: d*, left parapodium from abdominal setiger 24, posterior view; *e*, left thoracic parapodium from setiger 26, anterior view. *f*, *Orbinia michaelseni*, abdominal parapodium from setiger 23 (after Ehlers, 1897). *g*, *Orbinia kupfferi*, abdominal parapodium from setiger 23 (after Ehlers, 1875).

Orbinia (Phylo) kupfferi (Ehlers, 1875)

FIGURE 75*g*

Aricia kupfferi Fauvel, 1927, p. 18, fig. 5,*h–l*.—Wesenberg-Lund, 1950a, p. 30; 1950b, p. 74.

DESCRIPTION.—Length?, width up to 2 mm., segments numerous. Thoracic setigers about 15 (14–17). Thoracic neuropodial postsetal lobes with 7–9 papillae, with several rows of stout yellow pseudocrotchets (with tips enclosed in sheaths tapered to fine tips) or crotchets (tips blunt, sheaths broken), with a posterior row of crenulate capillary setae. Posterior few (3–5) thoracic neuropodia with 4–5 dark heavy lanceolate setae, the upper one often extending out further than the others. Abdominal region with neuropodia unequally bilobed, the upper lobe short, rounded, the lower one longer, pointed. Without interramal cirri; with small conical subpodal papilla or ventral cirrus (fig. 75*g*). Subpodal ventral or stomach papillae on about setigers 13–17, up to 20 papillae on each side.

Biology.—Dredged on bottoms of mud, muddy sand, and ooze.

Material examined.—Off Long Island Sound (*Albatross* Station 2105, 37°50′ N., 73°03′ W., 1,395 fathoms).

Distribution.—Greenland, Kara Sea, Norway, Danish waters, North Sea, Mediterranean, Davis Strait, off Long Island Sound. In 690 to 1,395 fathoms.

Orbinia (Orbinia) swani **Pettibone, 1957a**

Figure 75,*d*,*e*

Orbinia swani Pettibone, 1957a, p. 161, fig. 1.

Description.—Length? (more than 50 mm.), width up to 3 mm., segments numerous. With middorsal glandular areas beginning between setigers 6 and 7. Thoracic setigers about 31 (24–31). Thoracic neuropodial postsetal lobes with 5–18 papillae and with 4–5 rows of crotchets. Crotchets golden yellow, gently curved, smooth or faintly spinous. Two groups of crenulate capillary setae at the upper and near the lower part of the lobe (fig. 75*e*). Abdominal region with bilobed neuropodial lobe, the outer lobe slightly longer than the inner lobe. Without interramal cirri; with a prominent conical subpodal papilla or ventral cirrus at the base (fig. 75*d*). Subpodal ventral papillae on about setigers 18–40, up to 18 papillae on each side in transverse rows; most developed papillae nearly reach midventral line. Extended proboscis lobulated, with about eight short wide lobes (fully extended?). Color: colorless or yellowish except for prominent red blood vessels.

Biology.—Found at low water in sand. Dredged on bottoms of fine to coarse sand. Gut filled with sand grains.

Material examined.—Gulf of St. Lawrence (Bay of Chaleurs), Nova Scotia (east side Cape George, September 27, 1957, R. Lane, J. McNeill), Maine (York, Sea Point near Kittery), Massachusetts (Georges Bank, *Albatross* III, 41°31′ N., 68°23′ W., 25 fathoms; 40°48′ N., 68°25′ W., 25 fathoms, 1957, R. Wigley).

Distribution.—Gulf of St. Lawrence to Massachusetts. Low water to 25 fathoms.

Orbinia (Orbinia) ornata **(Verrill, 1873a)**

FIGURE 75,*a*,*b*

Aricia ornata Verrill and Smith, 1874, pp. 50, 71, 302.—Webster and Benedict, 1884, p. 724.—Andrews, 1891a, p. 292.—Sumner, Osburn, and Cole, 1913, p. 623.

Orbinia ornata Hartman, 1942b, p. 61; 1944a, p. 340, pl. 18, fig. 7, pl. 19, fig. 16 (as *Scoloplos armiger*); 1945, p. 28.

Phylo ornatus Hartman, 1951, p. 79; 1957, p. 265, pl. 24, figs. 1–10.

DESCRIPTION.—Length up to 250 mm., width up to 7 mm., segments up to 300. With middorsal reddish glandular areas beginning between setigers 7–8. Thoracic setigers (fig. 75,*a*,*b*) about 24 (19–32). Thoracic neuropodial postsetal lobes with 4–18 papillae, with several rows of crotchets (2–7 rows). Crotchets golden yellow or brown, faintly crenulate, curved, with blunt tips. A single posterior row of curved crenulate setae present, tapering to fine tips. In the more posterior thoracic neuropodia, some the the crotchets in the anterior row or the upper part of the lobe may be darker (perhaps worn; they do not appear to be specialized as in *Phylo*).

Abdominal region with paired straplike branchiae and paired digitiform notopodial postsetal lobes subequal, the branchiae as well as the inner sides of the notopodial lobes ciliated, thus forming three longitudinal ciliated grooves. Neuropodia shorter, with tips bilobed, with two short curved acicula and long slender capillary setae. Without interramal cirri. Subpodal part joining the rest of the body entire, smooth or undulate, without subpodal papillae or ventral cirri except on few (2–6) transitional abdominal segments, where there may be 1–2 subpodal papillae. Subpodal ventral or stomach papillae on 10–24 segments, beginning on about setiger 14 (12–15), few at first, becoming more numerous and forming a nearly complete semicircular row, then becoming fewer and disappearing on about setiger 36 (20–38). Anal ring with a pair of long, very slender anal cirri on the dorsolateral edge. Extended proboscis soft, saclike, forming a lobulated, rosettelike sac around the mouth. Color: yellow orange, yellowish red, deep red, reddish brown with bright red dorsal branchiae and parapodial lobes.

BIOLOGY.—They are found at low water on sandy or muddy shoals, muddy sand, gravelly sand. Dredged in shallow water on bottoms of silty sand. May form delicate mucous sandy tubes. Autotomize readily when removed from the sand. Sexually mature in the Woods Hole region, Massachusetts and Beaufort, North Carolina, in June and early July (Moore, MS. and Hartman, 1945). Eggs pale or yellowish.

MATERIAL EXAMINED.—Numerous specimens from Massachusetts (Cape Cod, Provincetown, Wellfleet, Truro, Barnstable; Woods Hole region, North and South Falmouth, Hadley Harbor, Nonamesset

Island, Nobska; Nantucket Sound, Lagoon Pond, Martha's Vineyard), Rhode Island, low water to 18 fathoms; Florida (Seahorse Key).

Distribution.—Off Massachusetts (Cape Cod) to Florida, Gulf of Mexico, southern California, Lower California, Mexico. Low water to 18 fathoms.

Genus *Scoloplos* Blainville, 1828

Haploscoloplos Monro, 1933a, type (original designation): *Haploscoloplos cylindrifer* (Ehlers, 1905).

Type (monotypy): *Scoloplos armiger* (O. F. Müller, 1776).

Subgenus *Califia* Hartman, 1957

Type (monotypy): *Califia calida* Hartman, 1957.

All the species represented have the body, long, slender, divided into anterior thoracic and posterior abdominal regions (fig. 76*a*). Thoracic region inflated, subcylindrical or more or less flattened, tapering rather abruptly anteriorly, with parapodia lateral. Abdominal region much longer than the thoracic region, semicircular in cross section, flattened dorsally, tapered gradually posteriorly, often fragmenting, with parapodia elongated, directed dorsally. Prostomium conical, without appendages, usually without eyes (fig. 76*c*). Single achaetous tentacular or buccal segment, without tentacular cirri. The buccal segment and the first setigerous segment involved in the mouth.

Thoracic setigers 12–33 (figs. 74*e*, 76*e*). Notopodium with a simple conical postsetal lobe (may be missing or inconspicuous in more anterior segments), with a fan-shaped group of crenulate capillary notosetae. Neuropodium with a simple conical postsetal lobe, with several transverse rows of neurosetae arranged in a fan-shaped group. Neurosetae may be all crenulate capillaries or some may be crotchets, with blunt tips.

Abdominal region (figs. 74*f*, 76,*f*,*g*) with parapodia directed dorsally. Notopodia with digitate or ligulate postsetal lobes, with a compact radiating tuft of crenulate capillary setae (there may be a few additional forked setae; broken crenulate capillary setae?). Neuropodia cylindrical with bilobed tip enclosing a small bundle of crenulate capillary setae. Where observed, posterior end with a single pair of long filiform anal cirri, ventrolateral on anal ring (fig. 76*b*). Branchiae begin on setigers 8–32, continuing to near end of body. Branchiae paired, simple, small, triangular at first, becoming long, ligulate in abdominal region, densely ciliated up to near distal tip.

Key to the New England Subgenera and Species of *Scoloplos*

1. First 3 setigers with neuropodia with special type of stout hooded spines, appearing frayed or brush tipped (fig. 74*d*); rest of thoracic setigers with neurosetae tapering to fine tips . . (subgenus CALIFIA).
S. (Califia) schmitti (p. 287)
Without special neuropodial spines on first 3 setigers . . (subgenus SCOLOPLOS, sensu stricto) 2
2. With interramal cirri on anterior abdominal segments (fig. 74*f*) 3
Without interramal cirri 5
3. With subpodal ventral or stomach papillae on some anterior segments.
S. (Scoloplos) riseri (p. 288)
Without subpodal ventral or stomach papillae 4
4. With 2–3 subpodal papillae in transitional region, followed by entire flattened subpodal flanges (may be undulate but not incised, fig. 76*g*).
S. (Scoloplos) robustus (p. 288)
With 2 subpodal papillae in transitional region continuing as 2 subpodal lobes, thus a notched or incised subpodal lobe (fig. 76*f*).
S. (Scoloplos) fragilis (p. 290)
5. With 1–2 extra subpodal papillae on last few thoracic and first few abdominal segments (fig. 76*h*); thoracic neuropodia usually with crotchets ending in blunt tips in addition to numerous neurosetae ending in capillary tips (fig. 76*i*) . . . . **S. (Scoloplos) armiger** (p. 292)
Without extra subpodal papillae on transitional segments or only on last thoracic segment; thoracic neuropodia with all neurosetae ending in capillary tips . . . . **S. (Scoloplos) acutus** (p. 293)

Scoloplos (*Califia*) *schmitti* Pettibone, 1957a

FIGURE 74*d*

Scoloplos (*Scoloplos*) *schmitti* Pettibone, 1957a, p. 164, fig. 3.
Califia schmitti Hartman, 1959a, p. 364.

DESCRIPTION.—Length? (more than 20 mm.), width up to 2 mm., segments numerous. Prostomium bluntly conical, about as wide as long. Branchiae begin on setigers 8–10. Thoracic setigers 13–14. First three setigers differ markedly from rest of thoracic setigers. Neuropodia form oval cushion-like lobes, without postsetal papillae, with 3 kinds of setae: (1) 2 rows of smooth, stout, reddish amber-colored spines with tips pointed and hooded, the hood frayed giving a brush-tipped appearance (fig. 74*d*); (2) anterior row of shorter, more slender crotchets, with frayed hood and transverse spinous rows; (3) upper small group of crenulate capillary setae. Rest of thoracic setigers with conical postsetal neuropodial lobes and several rows of crenulate capillary neurosetae.

Abdominal region with paired branchiae, with digitiform postsetal notopodial lobes, without interramal cirri, with bilobed neuropodia, with low entire subpodal flanges. Color, in alcohol: brownish banded middorsally.

BIOLOGY.—A deep water species, dredged on bottoms of mud.

Material examined.—Off Massachusetts to off Long Island Sound, *Albatross* Stations, 788 to 1,061 fathoms.

Distribution.—Deep Atlantic off Massachusetts to off Long Island Sound. In 788 to 1,061 fathoms.

Scoloplos (Scoloplos) riseri Pettibone, 1957a

Figure 74,*e*,*f*

Scoloplos (Scoloplos) riseri Pettibone, 1957a, p. 163, fig. 2.

Description.—Length? (more than 55 mm.), width up to 3 mm., segments numerous. Prostomium elongate conical, longer than wide, may be wrinkled, appearing biannulate, with a pair of inconspicuous eyes. Branchiae begin on about setiger 10 (8–10). Thoracic setigers about 19. Thoracic neuropodia with dense fan-shaped bundles of neurosetae, including several rows of crotchets (blunt tips) and some tapering to fine tips (fig. 74*e*).

Abdominal region with paired branchiae, with long lanceolate postsetal notopodial lobes, with digitiform interramal cirri (begin on about setiger 18, continuing for about 70 segments), with bilobed neuropodia. Transitional region with 1–2 extra postsetal neuropodial papillae (posterior 9 or so thoracic segments), with 1–9 or so subpodal ventral or stomach papillae on setigers 14–24 (last 6 thoracic, first 5 abdominal), with 2 subpodal conical papillae continuing on rest of body (fig. 74*f*).

Biology.—Found intertidally in sand with shells.

Material examined.—Type from Woods Hole, Massachusetts. Florida (Seahorse Key, west lagoon, J. Taylor, collector).

Distribution.—Massachusetts (Woods Hole region), Gulf of Mexico (Florida). Low water.

Scoloplos (Scoloplos) robustus (Verrill, 1873a)

Figure 76*g*

Anthostoma robustum Verrill and Smith, 1874, pp. 49, 54, 71, 134, 303, pl. 14, fig. 76.

Scoloplos robustus Verrill, 1881, pp. 301, 317.—Andrews, 1891a, p. 292.—Sumner, Osburn, and Cole, 1913, p. 624.

Scoloplos robusta Webster and Benedict, 1884, p. 724.

Scoloplos bustorus Hartman, 1942b, p. 58, figs. 110–112.

Haploscoloplos bustorus Hartman, 1945, p. 30.

Haploscoloplos bustoris Horn and Bookhout, 1950, p. 1, pls. 1–4.

Haploscoloplos robustus Hartman, 1951, p. 78, pl. 21, figs. 4–6; 1956, pp. 258, 268, 290; 1957, p. 272, pl. 25, figs. 4–6.

Description.—Length up to 375 mm., width up to 10 mm., segments up to 300. Prostomium acutely conical, longer than wide. Branchiae begin on about setiger 24 (16–32). Thoracic setigers about 23 (15–33). Thoracic neuropodia with dense fan-shaped bundles of neurosetae all ending in fine tips, without crotchets.

Abdominal region with long, straplike paired branchiae. Long, ligulate postsetal notopodial lobes (may become longer than branchiae), with a ciliated ridge near the inner side (the paired ciliated branchiae and paired ciliated notopodial lobes thus form 3 longitudinal ciliated grooves along the body). Slender, digitiform interramal cirri at bases of the neuropodia (usually begin on last few thoracic segments, continuing on 44–50 or so segments). Bilobed neuropodia, the inner lobe elongated, ligulate, the outer lobe small, rounded. In transitional region, 3 extra postsetal and subpodal papillae on last few thoracic (2–6) and first few abdominal segments (2–9), then with entire, broad, foliaceous subpodal flanges uniting the neuropodia with the sides of the body. The outer border of the flanges may be flaring or undulate but not incised (as in the closely related *S. fragilis*, fig. 76*g*).

Proboscis, when fully extended, forming a large voluminous, multilobed folded sac, divided into 5 main lobes, each of which is again divided into 3–4 long, slender, secondary lobes, convoluted at the margins, united at the base by a delicate web. In life the processes are continually changing their form (Moore, MS.). Color: orange-red, orange-yellow, with red middorsal blood vessel and branchiae.

Biology.—Found in vertical burrows in sand, muddy sand, sandy mud, gravelly sand, or mud. Dredged in rather shallow water on bottoms of fine sand and sandy mud. They break up easily when disturbed. They may be associated with the closely related *S. fragilis*, but attain a much larger size than the latter species.

The early development has been followed by Horn and Bookhout in the Beaufort, North Carolina, area. Mature worms are found in May through September. Apparently the females eject the eggs freely, not forming gelatinous egg cases as do some species in the family. The eggs develop into typical trochophores and ciliated larvae. After a short swimming stage of about 3 days, ciliation is lost and the larvae metamorphose. Juveniles of 7 days have 11 segments (8 setigers, first 2 and last segments achaetous), a pair of eyespots, 2 pairs of branchiae beginning on segment 10 (setiger 8). In maturing to the adult, branchiae would be lost, as in the adult the branchiae begin on about setiger 26 (16–32).

In the Woods Hole area, Massachusetts, it breeds in early July, probably throughout the summer (Moore, MS.). Many small ones were found in August (North Falmouth, August 24, 1950). In Maine, females massed with dull pinkish or orange eggs and males with white sperm masses were found in June and July (Woodbridge Island, June 29, 1955; Cape Newagen, July 8, 1955).

Material examined.—Numerous specimens from Gulf of St. Lawrence (Prince Edward Island), Nova Scotia (Lawrencetown and head Green Harbor, Halifax County; Peninsula leading to Caribou

Island, Pictou County), Maine (Glen Cove, mouth of Penobscot Bay; Boothbay Harbor region; Waites Landing, Falmouth Foreside, Casco Bay), New Hampshire (Hilton Park, Dover Point; Rye Harbor; Hampton Beach; Hampton Harbor near entrance to Blackwater River), Massachusetts (Georges Bank, 24–30 fathoms, R. Wigley; Marblehead; Duxbury; Woods Hole region; Elizabeth Islands; Martha's Vineyard; Nantucket Sound; Cape Cod), Rhode Island (Greenwich Bay; Potters Pond), North Carolina (Beaufort), Florida (Seahorse Key).

DISTRIBUTION.—Gulf of St. Lawrence to North Carolina, Gulf of Mexico. Low water to 31 fathoms.

Scoloplos (Scoloplos) fragilis **(Verrill, 1873a)**

FIGURE 76,*a–f*

Anthostoma fragile Verrill and Smith, 1874, pp. 50, 71, 304.—Webster, 1886, p. 151.
Scoloplos fragilis Verrill, 1881, pp. 301, 309, 317, 322.—Webster and Benedict, 1884, p. 724.—Andrews, 1891a, p. 293.—Sumner, Osburn, and Cole, 1913, p. 624.—Hartman, 1942b, p. 60, figs. 113–115.
Haploscoloplos fragilis Hartman, 1944a, p. 340, pl. 14, fig. 5, pl. 18, fig. 6; 1945, p. 30, pl. 6, fig. 5; 1951, p. 76, pl. 21, figs. 1–3; 1957, p. 271, pl. 25, figs. 1–3.

DESCRIPTION.—Length up to 150 mm., width up to 3 mm., segments up to 250. Prostomium elongate, acutely pointed, longer than wide, may be wrinkled, appearing biannulate, may be almost indistinguishable from the buccal segment (fig. 76*c*). Branchiae begin on about setiger 16 (11–23). Thoracic setigers about 16 (15–19). Thoracic neuropodia with dense fan-shaped bundles of neurosetae all ending in fine tips, without crotchets (fig. 76*e*).

Abdominal region with paired branchiae (usually begin on about first abdominal segment). Long lanceolate postsetal notopodial lobes with a ciliated ridge near the inner side (the paired ciliated branchiae and paired ciliated notopodial lobes thus form 3 longitudinal ciliated grooves along body). Interramal cirri at bases of the neuropodia (usually begin on first abdominal segment, continuing on 35–50 or so segments). Bilobed neuropodia, the inner lobe gradually becoming more elongate, the outer lobe short, with 2 rounded subpodal papillae on first few abdominal segments, then becoming more pointed, conical (thus it may appear as a 5-slashed membrane, including the interramal cirrus, bilobed neuropodium and 2 subpodal papillae or ventral cirri; fig. 76*f*).

Proboscis, when fully extended, forming a short voluminous multilobed folded sac, with 6–8 or so lobes (fig. 76*d*). The lobes are broad, convoluted, changeable in form, united at the base by a broad membranous expansion. When partially extended, it may appear as two balloon-like lobes. Color: dull yellow, orange brown, greenish, pale red, reddish yellow, with red middorsal blood vessel and red to red-brown branchiae.

Biology.—Found burrowing in bottoms of sand, muddy sand, and sandy mud. They may be gregarious, since they are found in large numbers in restricted areas, and may be associated with the closely related *S. robustus*, the latter getting to be considerably larger in size. According to Moore (ms.), they are found in pure sand, where

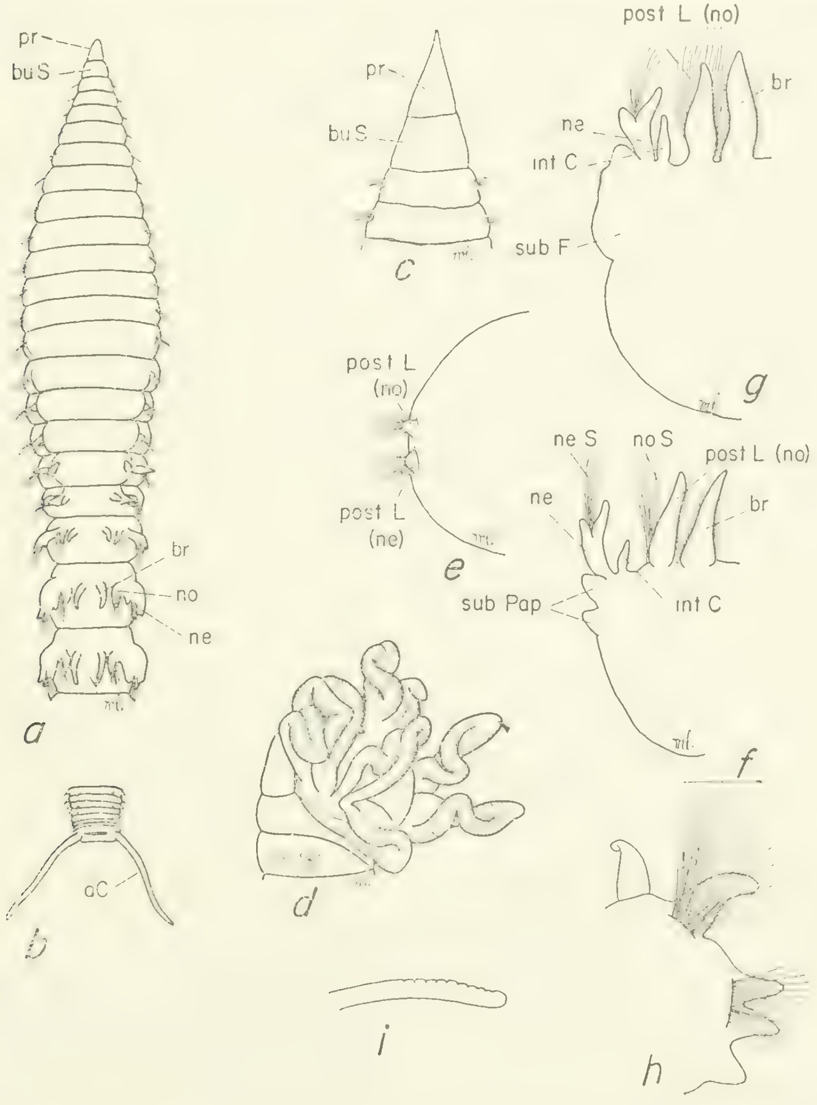
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Figure 76.—Orbiniidae, *a–f*, *Scoloplos fragilis:* *a*, dorsal view thoracic region and first few abdominal segments; *b*, dorsal view posterior end; *c*, dorsal view anterior end; *d*, lateral view anterior end with proboscis extended; *e*, thoracic parapodium, posterior view; *f*, abdominal parapodium, posterior view. *g*, *Scoloplos robustus*, abdominal parapodium, posterior view. *h–i*, *Scoloplos armiger* (after Okuda, 1937b): *h*, transitional parapodium from setiger 15; *i*, crotchet-like neuroseta.

they attain their largest size, as well as in the foulest organic mud in sheltered coves. Those living in mud are usually smaller. They are dredged in shallow waters and may occur in brackish or estuarine waters, as the Eel Pond, Edgartown, Martha's Vineyard. In the Woods Hole region, they breed abundantly in July and early August. The eggs are easily fertilized artificially (Moore, MS.). Females with eggs massed in the body were found in June and July (West Falmouth, June 25, 1954, July 6, 1954; Eel Pond, Edgartown, June 25, 1954; Sippowisset, July 25, 1953). In Maine, females with whitish to yellowish eggs and males with white sperm masses were found in July (Little River, Georgetown Island, July 3, 1955).

MATERIAL EXAMINED.—Numerous specimens from Gulf of St. Lawrence (lagoon, Madeleine Island), Newfoundland (St. George estuary), Nova Scotia (Cape Breton Island, head Cheticamp Inlet), Maine (Sagadahoc Bay and Little River, Georgetown Island; Brave Boat Harbor, north of Sea Point), New Hampshire (Emerson Beach, Oyster River, Hampton Beach), Massachusetts (Plum Island, Martha's Vineyard, Woods Hole region, Elizabeth Islands, Cape Cod), Long Island Sound (Noank Harbor), Maryland (Chincoteague Bay, Chesapeake Bay), Virginia (Norfolk), Florida (Seahorse Key, Pensacola), Mississippi (off 9-Mile Bayou).

DISTRIBUTION.—Gulf of St. Lawrence, Newfoundland to Florida, Gulf of Mexico. Low water to 56 fathoms.

Scoloplos (Scoloplos) armiger (O. F. Müller, 1776)

FIGURE 76,*h*,*i*

Scoloplos armiger Webster and Benedict, 1887, p. 738.—Fauvel, 1927, p. 20, fig. 6,*k*–*q*.—Procter, 1933, p. 140.—Hartman, 1944a, p. 340, pl. 18, fig. 5; 1957, p. 280, pl. 29, figs. 1–7.—Thorson, 1946, p. 78, fig. 37.—Smidt, 1951, p. 53, fig. 21.—Wesenberg-Lund, 1953, p. 54.—Newell, 1954, p. 334.—Grainger, 1954, p. 516.—Pettibone, 1954, p. 278, fig. 32,*a*–*e*.—Uschakov, 1955, p. 258, fig. 86.—Kirkegaard, 1959, p. 15.—Anderson, 1959, p. 89.—Clark, 1960, p. 24.

Scoloplos armigera Hartmann-Schröder, 1959, p. 163.

DESCRIPTION.—Length up to 120 mm., width up to 2.5 mm., segments up to 200. Prostomium conical, acutely pointed, with a pair of deep-set eyes (not usually visible when preserved). Branchiae begin on about setiger 12 (9–17). Thoracic setigers about 17 (12–20). Thoracic neuropodia with dense fan-shaped bundles of neurosetae, mostly ending in fine tips. Some neurosetae in the lower or anterior part of the bundle may be worn down, with blunt tips, resembling crotchets (the crotchets may occur in all the thoracic segments, in some only or may be lacking, fig. 76*i*).

Abdominal region with paired branchiae, with erect digitiform postsetal notopodial lobes, without interramal cirri but with interramal ciliated organs near the bases of the notopodia, with unequally bilobed neuropodia. The transitional region with 1–2 extra papillae on the last few thoracic (1–5, fig. 76*h*) and first few abdominal segments (1–7), then with elongate, thickened, entire subpodal flanges uniting the neuropodia with the sides of the body. Proboscis forming a soft, more or less lobed sac around the mouth. Color: red or reddish orange.

BIOLOGY.—Found at low water on bottoms of sand, fine mud, gravelly sand, roots of eelgrass (*Zostera*). Dredged on bottoms of mud, sand, and various combinations of mud, sand, gravel, stones, rocks. In European waters (Scotland, Holland, Danish waters), they spawn from the end of February to June (Thorson, 1946; Smidt, 1951; Newell, 1954; Anderson, 1959). Fertilized eggs are laid in gelatinous pear-shaped cocoons attached to the sand by a tough string. The larvae hatch from the cocoon after about three weeks when they are in the crawling stage. Pelagic stages are lacking. Larvae of 11 setigers have 2 pairs of large branchiae beginning on setiger 9. Details of its embryology and early development have been worked out by Anderson (1959).

MATERIAL EXAMINED.—Off Newfoundland (*Albatross* Station 2438, 46°48′ N., 52°34′ W., 89 fathoms), Nova Scotia (Clark's Harbor and Partridge Island), New Brunswick (Grand Manan; St. Andrews), Maine (Rock ledge opposite C–1 Buoy, Sheepscot River), Massachusetts (*Albatross* III, 40°37′ N., 67°28′ W., 47 fathoms, R. Wigley), Washington (Crescent Beach near Dutchers Cove, Case Inlet, Puget Sound).

DISTRIBUTION.—Circumpolar, widely distributed in the Arctic. Also Iceland, Faroes, Shetlands to France, Mediterranean, Labrador to Massachusetts, Bering Sea to California, Central America (El Salvador), north Japan Sea to Japan, South Pacific (Chile), Antarctic, off West and South Africa. Low water to 1,100 fathoms.

***Scoloplos* (*Scoloplos*) *acutus* (Verrill, 1873a)**

FIGURE 74*g*

Anthostoma acutum Verrill and Smith, 1874, pp. 122, 128, 134, 207, 214, 305.—Verrill, 1874b, pp. 351, 355, 367, 384.
Scoloplos acutus Verrill, 1881, pp. 301, 305, 309.—Procter, 1933, p. 141.

DESCRIPTION.—Length up to 40 mm., width up to 1 mm., (2.5 mm.?, Verrill), segments numerous. Prostomium sharply conical, longer than wide. Branchiae begin on about setiger 12 (10–14). Thoracic setigers about 14 (13–15). Thoracic neuropodia with fan-shaped bundles of neurosetae all ending in fine tips, without crotchets.

Abdominal region with paired branchiae. With long ligulate, postsetal notopodial lobes (inner border not ciliated as in *S. fragilis* and *S. robustus*). Without interramal cirri but with interramal ciliated organs near the bases of the notopodia. With bilobed neuropodia, the lobes subequal at first, then the inner lobe becoming longer. With subpodal flanges uniting the neuropodia with the sides of the body, the outer border of the flanges entire but may be undulate. Usually without transitional subpodal papillae (may be 1 extra papilla on last thoracic segment). Proboscis forming a 5-lobed sac. When partially extended, it shows a tubular base with 2 or more lobes distally. Color: light red or pale (with yellow digestive tract showing through).

Remarks.—*Anthostoma acutum* Verrill, 1873a (=*S. acutus* Verrill, 1881), has been referred to *S. armiger* by Webster and Benedict (1887, p. 738) and Hartman (1944a, p. 340). The types of *A. acutum* were examined in the U.S. National Museum. *S. acutus* differs from *S. armiger* in that it lacks extra papillae in the transitional segments (in *S. armiger*, there are 1–2 extra subpodal papillae on the last few thoracic and first few abdominal segments, up to 2–20 segments involved). *S. acutus* appears to have all the thoracic neurosetae ending in capillary tips (in *S. armiger*, some crotchets are usually found among the numerous capillary setae). Perhaps some of the records of *Scoloplos kerguelensis* McIntosh, 1885, refer to *S. acutus*.

Biology.—Dredged on bottoms of sticky and soft mud, fine to coarse sand and various combinations of mud, sand, gravel, pebbles, rocks, shells, worm and amphipod tubes. Specimens with large yolky coral-pink eggs massed inside were found in Cape Cod Bay, Massachusetts in July (July 24, 1953; July 8, 1954).

Material examined.—Numerous specimens from Canadian Arctic (Sylvia Grinnel River, Frobischer, Baffin Land, 1942, R. A. Bartlett), Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, 3–60 fathoms), Maine (Ebenecook Harbor, Southport Island, 3–7 fathoms; north end Long Ledge, Sheepscot River, 3 fathoms; Muscongus Bay near Hog Island, 3 fathoms; N.W. Eastern Point Light, 26–45 fathoms), New Hampshire (Isles of Shoals, 27–48 fathoms), Massachusetts (Georges Bank, 37–98 fathoms, R. Wigley; Massachusetts Bay off Plymouth, 17–26 fathoms; Vineyard Sound, 16–27 fathoms; Cape Cod Bay, 13–27 fathoms; *Albatross* Station 2240, 40°27′ N., 70°29′ W., 44 fathoms), Long Island Sound (Little Peconic Bay, Long Island, 7–14 fathoms), off Chesapeake Bay (*Albatross* Station 2306, 35°21′ N., 74°52′ W., 41 fathoms).

Distribution.—Canadian Arctic (Baffin Land) to off Chesapeake Bay. In 3 to 98 fathoms.

Family Apistobranchidae

Body elongate, vermiform, cylindrical, fragmenting readily. Prostomium and buccal segment fused, oval, with a pair of nuchal folds and a pair of long contractile spioniform tentacular palps (deciduous, may be missing or short regenerating).

Body divided into 2–3 more or less distinct regions: (1) Anterior thoracic region (7 setigers) with well-developed neuropodia with numerous rows of simple setae, with fimbriated subpodal flanges on some segments, with cylindrical notopodia with delicate internal acicula, without notosetae, with interramal cirri (figs. 77,*a–c;* 78,*a*,*b*); (2) middle or transitional region (setigers 8–11) with smaller bundles of neurosetae, with fimbriated subpodal flanges, with notopodia more slender (may be absent, figs. 77*b*, 78*c*); (3) posterior abdominal region with slender cylindrical notopodia with internal acicula, with cylindrical neuropodia supported by acicula and few slender neurosetae (figs. 77*b*, 78*d*).

Pygidium with anal cirri. Without branchiae, although the notopodia and interramal cirri are ciliated externally and have extensions of the coelomic cavity and thus may have branchial functions. Proboscis eversible, globular, disclike. Evidently the apistobranchids live in tubes on soft bottom. They are probably bottom deposit feeders. They are small and delicate, and are easily overlooked.

The Apistobranchidae as established by Mesnil and Caullery (1898) and as herein defined is limited to a single aberrant genus and species. It is allied to the Orbiniidae (parapodia supported by acicula, with some fimbriated postsetal lobes as in *Orbinia*, with some interramal cirri), Paraonidae (smooth setae with mucronate tips), and Spionidae (paired tentacular palps, prostomium and buccal segment fused).

Contains only one known genus.

Genus *Apistobranchus* Levinsen, 1883

Ethocles Webster and Benedict, 1887; type (monotypy): *Ethocles typicus* Webster and Benedict, 1887; = *Apistobranchus tullbergi* (Théel, 1879).

Skadaria Wesenberg-Lund, 1951; type (monotypy): *Skadaria fragmentata* Wesenberg-Lund, 1951; = *Apistobranchus tullbergi* (Théel, 1879).

Type (author's designation): *Apistobranchus tullbergi* (Théel, 1879). Contains only one known species.

Apistobranchus tullbergi (Théel, 1879)

FIGURES 77–78

Aricia tullbergi Théel, 1879, p. 45, pl. 3, figs. 40–43.

Ethocles typicus Webster and Benedict, 1887, p. 733, pl. 6, figs. 77–85.

Apistobranchus tullbergi Eliason, 1916, p. 6, pl. 1, fig. 7, text-figs. 1–2; 1920, p. 39.—Southward, 1956, p. 268, fig. 1,*q–t*.—Uschakov, 1958a, p. 87, fig. 6.

Skadaria fragmentata Wesenberg-Lund, 1951, p. 59, figs. 1–4.

Description.—Length? (more than 12 mm.), width up to 2 mm., segments? (more than 28). Body elongate, cylindrical, wider and flattened in anterior thoracic region, tapering slightly posteriorly. Prostomium and buccal segment suboval, about as wide as long, rounded anteriorly or slightly pointed, without antenna or eyes, with a pair of nuchal folds projecting above first setiger and lateral to the tentacular palps. Tentacular palps very long (may be longer than the body, according to Eliason), with a longitudinal groove. The palps are contractile and deciduous; thus they are variable in length when contracted or regenerating (fig. 77,*a*,*b*). First setiger extended forward ventrally forming lateral and lower lips for the mouth. Proboscis eversible, short, globular, disclike (not lobed).

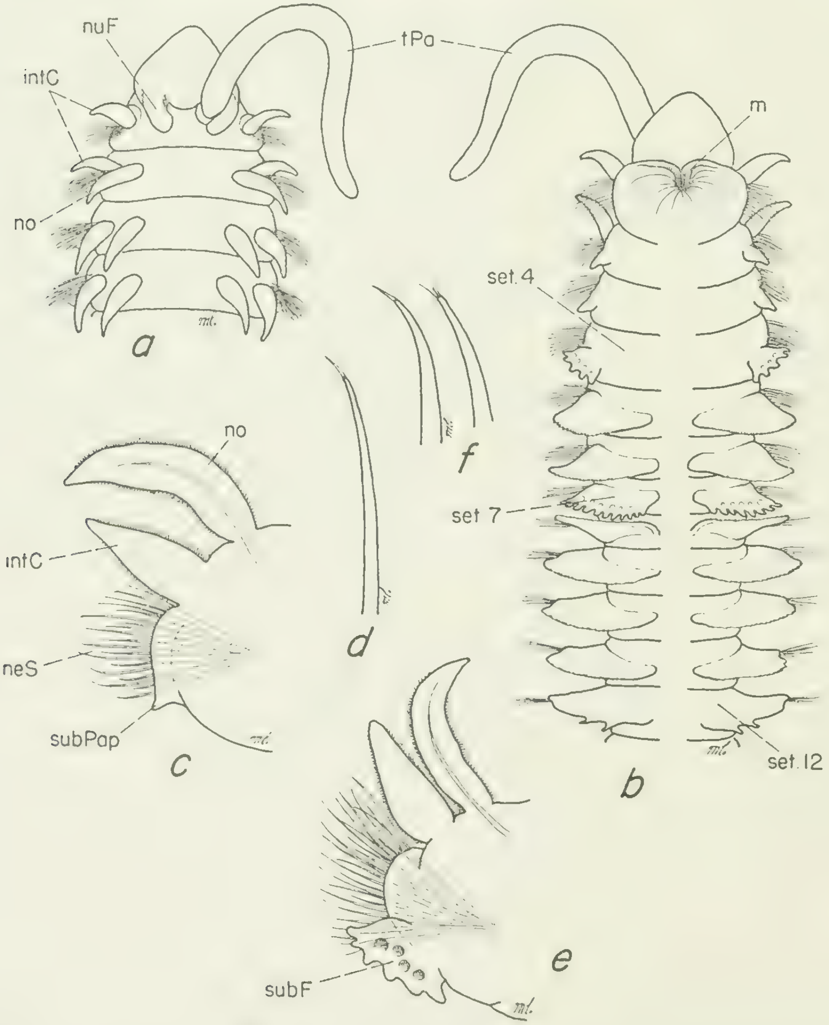

Figure 77.—Apistobranchidae, *Apistobranchus tullbergi: a*, dorsal view anterior end; *b*, same, ventral view; *c*, parapodium from setiger 2, posterior view; *d*, neuroseta from same; *e*, parapodium from setiger 4, posterior view; *f*, neurosetae from same.

Thoracic region (figs. 77,*a,e;* 78,*a,b*) with 7 setigers, with notopodia beginning on setiger 2 (lacking on first and sometimes on setiger 7), elongate, lanceolate, ciliated up to near distal tip, supported internally by single long transparent aciculum, without notosetae. Interramal cirri dorsal to neuropodia beginning on first setiger (6–7 pairs, may be lacking on setiger 7), elongate, lanceolate, ciliated up to near distal tip. Neuropodia lateral, with thick bundles of reddish-bronzy or amber-colored neurosetae arranged in several rows. Neurosetae simple, wide basally and tapering to slender tips, smooth or with delicate diagonal striations, the tips with fine sheaths, appearing as mucronate tips, sometimes frayed (fig. 77,*d–f*). Setigers 5–7 with setae gradually diminishing in number, forming a small bundle in setiger 7 (fig. 78,*a,b*). Neuropodial postsetal lamellae on first 3 setigers low, with lower part slightly extended subpodally, forming a subpodal papilla (sometimes referred to as ventral cirrus). On setiger 4, postsetal lamella may be extended subpodally to form lobulated lobe with 4–6 papillae (fig. 77*c*, not shown by Théel or Wesenberg-Lund). Setigers 5–7 with postsetal lamellae extended ventrally nearly to midventral line and forming a subpodal flared flange with margins finely fringed with numerous conical papillae on setigers 5 and 6 (fig. 78*a*), coarsely fringed with about 10 conical papillae (6–14) on setiger 7 (fig. 78*b*).

Middle or transitional region (figs. 77*b*, 78*c*) with 4 setigers (setigers 8–11), with notopodia more delicate and cylindrical (sometimes lacking on setigers 8–10), without interramal cirri. Neuropodia elongate conical with few long delicate setae, with subpodal flared flange with margins finely papillate (similar to setigers 5 and 6).

Posterior region beginning on setiger 12 (figs. 77*b*, 78*d*). Cylindrical notopodia with more slender tips, ciliated up to near tips, supported by internal acicula. Neuropodia long, cylindrical, supported by few acicula with tips curved, with small bundle of long slender setae. Setae wider basally, tapered to fine mucronate tips (setae may be broken and worn in various irregular ways, including some with split tip as shown by Théel). Subpodally with variable number of conical papillae (0–4). With transverse dorsal ciliated bands between notopodia. Pygidium with 2 filiform anal cirri (2 lateroventral ones according to Webster and Benedict; 2 dorsal and 1 ventral one according to Eliason). Color: white or yellowish white; setae yellowish brown or reddish amber colored.

Biology.—They probably live in tubes. They are delicate, fragile, fragmenting readily. Dredged on bottoms of fine to coarse sand, soft mud, clay with shells, sand with gravel and shells. They may be very abundant, as Eliason (1920) reported 349 specimens in 0.4 square meter in the Oersund region.

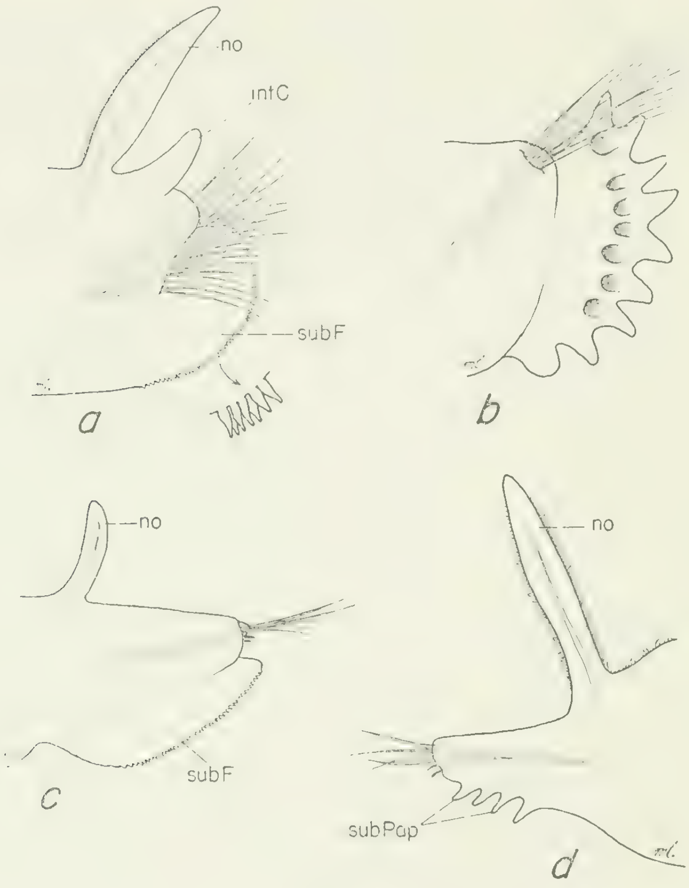

FIGURE 78.—Apistobranchidae, *Apistobranchus tullbergi: a*, parapodium from setiger 5, anterior view; *b*, same, from setiger 7 (notopodium and interramal cirrus missing); *c*, same, from setiger 11; *d*, same, from setiger 18.

MATERIAL EXAMINED.—Type slides of *Ethocles typicus* Webster and Benedict from Eastport, Maine. Few specimens from Gulf of St. Lawrence (Bay of Chaleurs, 15 fathoms), Maine (Ebenecook Harbor, Southport Island, 9–12 fathoms), Massachusetts (Georges Bank, 44–46 fathoms, R. Wigley; Cape Cod Bay near Cape Cod Canal, 12–21 fathoms).

DISTRIBUTION.—Novaya Zemlya, Sweden, Iceland, Danish waters, British Isles, Gulf of St. Lawrence to Massachusetts, Okhotsk Sea. In 3 to 46 fathoms.

Family Paraonidae (=Levinseniidae)

Body long, slender, threadlike, with numerous segments. Prostomium distinct, simple, subconical, sometimes terminating anteriorly in an unpaired sensory papilla capable of retraction, with or without dorsal median antenna, with or without a pair of small eyespots.

First or buccal segment achaetous, distinct or more or less fused with prostomium, without tentacular cirri or tentacular palps (as in Spionidae), usually with a pair of nuchal organs or slits. Parapodia biramous, essentially without setal lobes, without internal acicula, with conical, cirriform or filiform postsetal notopodial lobes (sometimes referred to as dorsal cirri) and with or without postsetal neuropodial lobes (sometimes referred to as ventral cirri) on some anterior segments.

Setae all simple, smooth or faintly striated (not crenulate or ringed as in Orbiniidae), of various kinds: slender, capillary; limbate, capillary, faintly striated; crotchets or acicular setae on some posterior segments; lyrate setae. Branchiae dorsal to notopodia, simple, paired, straplike or wide foliaceous, ciliated, absent from few anterior segments (3–6) and a long posterior region (4–60 pairs of branchiae). Anal cirri 2–3. Anterior region of digestive tube evaginable as a cylindrical or feebly lobed proboscis. Intestine contains numerous greenish granules in intestinal epithelium.

The paraonids live in mud or sand where they may be surrounded by a thin tube of sand cemented by mucus but without any firmness. They are evidently bottom-deposit feeders; sand grains may be found in the gut. The anterior branchial part may be more or less straight, the more posterior part may curl up in a tight spiral or in a knot. The anterior part typically is pale pink, the more posterior part taking on a greenish tint. Some paraonids have pelagic larvae recalling those of the spionids, minus the tentacular palps. The paraonids are probably more widely distributed than their sparse records might indicate, since they are in general very small, slender, threadlike, delicate, and easily overlooked.

Key to the Genera of Paraonidae

1. Without dorsal antenna (fig. 79*a*) . . . . **Paraonis** (p. 299)
With dorsal median antenna (fig. 80,*a,h*) . . . . **Aricidea** (p. 303)

Genus *Paraonis* Grube, 1873

Levinsenia Mesnil, 1897; type (herein designated): *Levinsenia fulgens* (Levinsen, 1883).

Type (monotypy): *Paraonis tenera* Grube, 1873.

Subgenus *Paraonides* Cerruti, 1909

Type (monotypy): *Paraonis* (*Paraonides*) *neapolitana* Cerruti, 1909.

The species represented have the body slender, cylindrical, slightly flattened anteriorly. Prostomium conical, lacking a median antenna, the anterior end terminating in a sensory tip (sometimes referred to as a terminal tentacle or palpode) which may be invaginated, with a pair of nuchal slits (fig. 79*a*). Achaetous buccal segment more or less fused with prostomium. Parapodia with notopodial postsetal lobes small, inconspicuous or short, digitiform on anterior segments (fig. 79,*c*,*e*), becoming slender, filiform in postbranchial segments (fig. 79,*d*,*f*); without neuropodial postsetal lobes.

Key to the New England Subgenera and Species of *Paraonis*

1. With modified setae in notopodia in addition to capillary setae . . (subgenus PARAONIDES) . . With few short lyrate setae in addition to capillary setae in notopodia, beginning in branchial region (fig. 79*g*). Without modified setae in posterior neuropodia. Branchiae begin on setigers 4–5, 7–17 pairs, straplike. Prostomium without eyes. . . **P. (Paraonides) lyra**

   With only capillary setae in notopodia, without modified setae. With modified setae in addition to capillary setae in posterior neuropodia . . (subgenus PARAONIS, sensu stricto) 2

2. Branchiae begin on setigers 6–7, 9–14 pairs, straplike, pointed (fig. 79,*a*,*c*). Prostomium without eyes. Posterior neuropodia with up to 5–6 curved, slightly hooked acicular setae (begin on about setiger 20, fig. 79*d*). **P. (Paraonis) gracilis**

   Branchiae begin on setiger 4, 16–25 pairs, wide, foliaceous, terminating in narrow tips (fig. 79*e*). Prostomium with pair of small lateral deep-set eyes. Posterior neuropodia with 1–2 hooked acicular setae (begin on about setiger 50; fig. 79*f*) . . . . **P. (Paraonis) fulgens**

Paraonis (Paraonides) lyra **Southern, 1914**

FIGURE 79*g*

Paraonis (*Paraonides*) *lyra* Fauvel, 1927, p. 72, fig. 24,*a-f*.—Southward, 1956, p. 269.—Hartman, 1957, p. 334.—Marinov, 1959, p. 96, fig. 12.—Eliason, 1962, p. 262.

Paraonis lyra var. *capensis* Day, 1955, p. 417.

DESCRIPTION.—Length up to 20 mm., width up to 0.3 mm., segments up to 105. Notosetae and neurosetae slender capillaries; in addition beginning in branchial region, with 1–3 shorter lyrate setae in lower part of notopodial bundle (fig. 79*g*). Anal end with 3 short subequal filiform anal cirri, 2 dorsolateral and 1 midventral. Branchiae begin on setigers 4–5, about 7 pairs (7–17). Colorless.

BIOLOGY.—Dredged on bottoms of sand, muddy-sand with fine gravel, grey ooze. Mature males found at surface in June in Ireland (Southern, 1914); females with 4 large red eggs per segment.

MATERIAL EXAMINED.—Gulf of St. Lawrence (Gaspé Bay, 8 fathoms), off Massachusetts (Albatross Station 2192, 39°46′ N., 70°14′ W., 1,060 fathoms, 1884), off Nova Scotia (*Delaware* Station, 42°43′ N., 66°02′ W., 43 fathoms, 1959, R. Wigley).

DISTRIBUTION.—Denmark, British Isles, Black Sea, Gulf of St. Lawrence to Massachusetts, South Africa, off southern California. In 1 to 1,060 fathoms.

Paraonis (Paraonis) gracilis (Tauber, 1879)

FIGURE 79,*a-d*

Paraonis gracilis Eliason, 1920, p. 55.—Monro, 1930, p. 150, fig. 58,*a-d*.—Wesenberg-Lund, 1950a, p. 32, pl. 7, fig. 34; 1951, p. 73; 1953, p. 59.—Uschakov, 1955, p. 286, fig. 103,*a,b*.—Southward, 1956, p. 269.—Hartman, 1957, p. 330, pl. 44, figs. 4–5; 1960b, p. 110.

DESCRIPTION.—Length up to 25 mm., width up to 0.5 mm., segments up to 100. Parapodia with notosetae long, slender, capillary, slightly limbate, becoming more slender posteriorly. Neurosetae long, capillary. In more posterior segments (beginning on about setiger 20) neurosetae of two kinds: 1–3 very long, fine capillary setae; 3–6 short, stouter acicular setae in transverse row, with tips slightly curved, darker amber-colored basally (fig. 79*d*). Proboscis an eversible sac, somewhat lobulate, appearing ciliated. Anal end

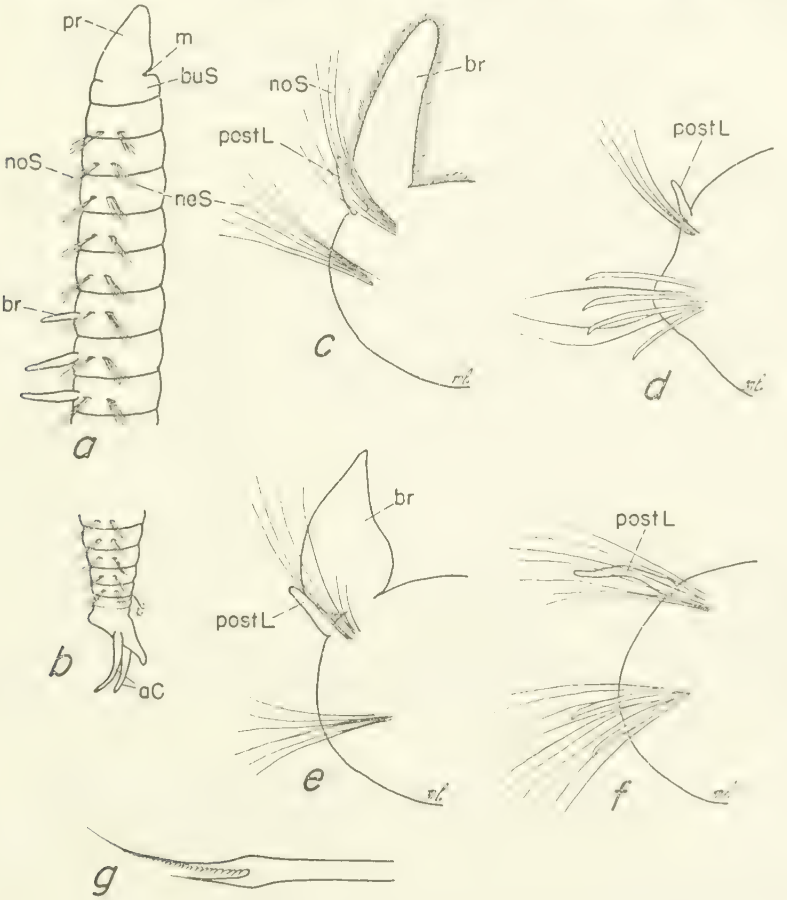

FIGURE 79.—Paraonidae, *a–d*, *Paraonis gracilis*: *a*, lateral view anterior end; *b*, same, posterior end; *c*, branchial segment; *d*, posterior segment. *e–f*, *Paraonis fulgens*; *e*, branchial segment; *f*, posterior segment. *g*, *Paraonis lyra*, lyrate notoseta (after Southern, 1914).

(fig. 79*b*) tapers to pointed end, with a pair of filiform anal cirri. Colorless.

Biology.—Dredged on bottoms of soft and sticky mud, muddy sand, mud with stones, gravel, and tubes. Dark material found in gut, evidently a bottom-deposit feeder. Females with large yolky, coral-pink eggs, about 2 per segment dorsally; males with white sperm masses; found in Maine in August (August 2, 1955, Ebenecook Harbor).

Material examined.—Gulf of St. Lawrence (Bay of Chaleurs, 26–33 fathoms), Maine (Ebenecook Harbor, Southport Island, 3 fathoms; north end Long Ledge, Sheepscot River, 3 fathoms), Massachusetts (Massachusetts Bay, Cape Cod Bay, Vineyard Sound, 10–27 fathoms).

Distribution.—Bering Sea, Greenland, Iceland, Faroes, Danish waters to British Isles, Gulf of St. Lawrence to Massachusetts, Antarctic. In 3 to 1,112 fathoms.

***Paraonis* (*Paraonis*) *fulgens* (Levinsen, 1883)**

Figure 79,*e*,*f*

Paraonis fulgens Fauvel, 1927, p. 71, fig. 24, *g–l*.—Southward, 1956, p. 268.—Marinov, 1959, p. 95, fig. 11.

Description.—Length up to 30 mm., width up to 1 mm., segments up to 120. Notosetae and neurosetae forming fan-shaped bundles of capillary setae, some long, some short, limbate, strongly arched. Neurosetae in posterior region (beginning on about setiger 50) with 1–2 additional neuropodial hooked crotchets (fig. 79*f*). Anal end with 3 filiform anal cirri, subequal or dorsal pair longer than median ventral one. White with greenish-yellow pigment, pale pink in branchial region, rest with greenish tint.

Biology.—Found at low water in sandy beaches. Dredged on bottoms of mud. They may be surrounded by thin tubes of sand without any firmness, probably cemented by mucus. Deprived of sand, they roll in a knot except for the anterior branchial part. Females were found with large violet colored eggs (massed in the postbranchial region) during August in Massachusetts (Wellfleet Harbor, August 25, 1953).

Material examined.—Maine (Sagadahoc Bay, Georgetown Island; Middle Cove, Ebenecook Harbor, Southport Island), Massachusetts (Stony Beach, Woods Hole; Lagoon Pond, Martha's Vineyard; Wellfleet, Cape Cod).

Distribution.—Denmark, British Isles to English Channel, Maine to Massachusetts. Low water to few fathoms.

Genus *Aricidea* Webster, 1879

Type (monotypy): *Aricidea fragilis* Webster, 1879.

The species represented have the body slender, cylindrical, more or less flattened anteriorly. Prostomium rounded anteriorly, wider and convex on posterior half, with a median antenna in about the middle of the prostomium (rarely missing, indicated by a scar or low ceratophore), with a pair of nuchal organs or slits which may be darkly pigmented. Achaetous buccal segment more or less fused with prostomium and ventrally forming lateral lips of mouth. First 2 segments forming a lobulated lower or posterior lip. Branchiae begin on setiger 4, turned posteromedially on dorsum, ciliated. Notopodia and neuropodia with thick bundles of capillary setae in anterior region (fig. 80*c*). Notopodia with only capillary setae, without acicular setae (subgenus *Aricidea*, sensu stricto). Notopodial postsetal lobes short, conical in prebranchial segments; longer, digitiform, wider basally in branchial segments; more delicate, filiform in postbranchial segments. Where observed, anal end with 3 short slender anal cirri, 2 lateroventral ones longer, medioventral one shorter.

Key to the New England Species of *Aricidea*

1. Median antenna long, filiform, extending to about setigers 4–6 (fig. 80*h*). Postbranchial segments with 1 to few S-shaped neuropodial crotchets (fig. 80*i*). Branchiae 9–10 pairs . . . . . . **A. (Aricidea) quadrilobata**

   Median antenna short, extending at most to setiger 2 (fig. 80*a*). Postbranchial segments without S-shaped neuropodial crotchets 2

2. Posterior parapodia with neurosetae all capillaries (fig. 81*f*). With distinct conical postsetal neuropodial lobes on first setiger (fig. 81,*b*,*d*), low rounded lobes on following 20 or so setigers (fig. 81*e*), absent from following. Branchiae 26–30 pairs . . . . **A. (Aricidea) albatrossae**

   Posterior parapodia with neurosetae of 2 kinds: (1) Long, slender, capillary; (2) shorter, stouter (fig. 80*d*). Without distinct postsetal neuropodial lobes on first setiger. Branchiae 10–24 pairs 3

3. Posterior parapodia with stouter neuropodial hooked crotchets, hooded or with faint sheath (fig. 80*e*). Usually darkly pigmented. **A. (Aricidea) jeffreysii**

   Posterior parapodia with stouter neurosetae straight or slightly curved, with terminal mucronate tips (fig. 80*g*). Whitish (not darkly pigmented). **A. (Aricidea) suecica**

Aricidea (*Aricidea*) *quadrilobata* Webster and Benedict, 1887

FIGURE 80,*h*,*i*

Aricidea quadrilobata Webster and Benedict, 1887, p. 739, pl. 8, figs. 93–96.

DESCRIPTION.—Length up to 6 mm., width up to 0.6 mm., segments about 100. Branchiae 9–10 pairs, broad at base, abruptly pointed distally (fig. 80*h*). Notosetae of posterior segments long, fine, capillary, forming spreading bundles, sometimes spreading out and covering the middorsum, giving a straggly appearance. Neurosetae of postbranchial region with upper ones long, slender, capillary, middle ones curved, with mucronate tips, with few lower ones shorter, heavier, hooked (fig. 80*i*). With conical to fusiform neuropodial postsetal lobes in prebranchial and branchial segments, lacking in posterior segments. Eversible proboscis short, saclike. Color, in life: light green, branchiae green with red center, setae glistening white; color, in alcohol: diffused brownish.

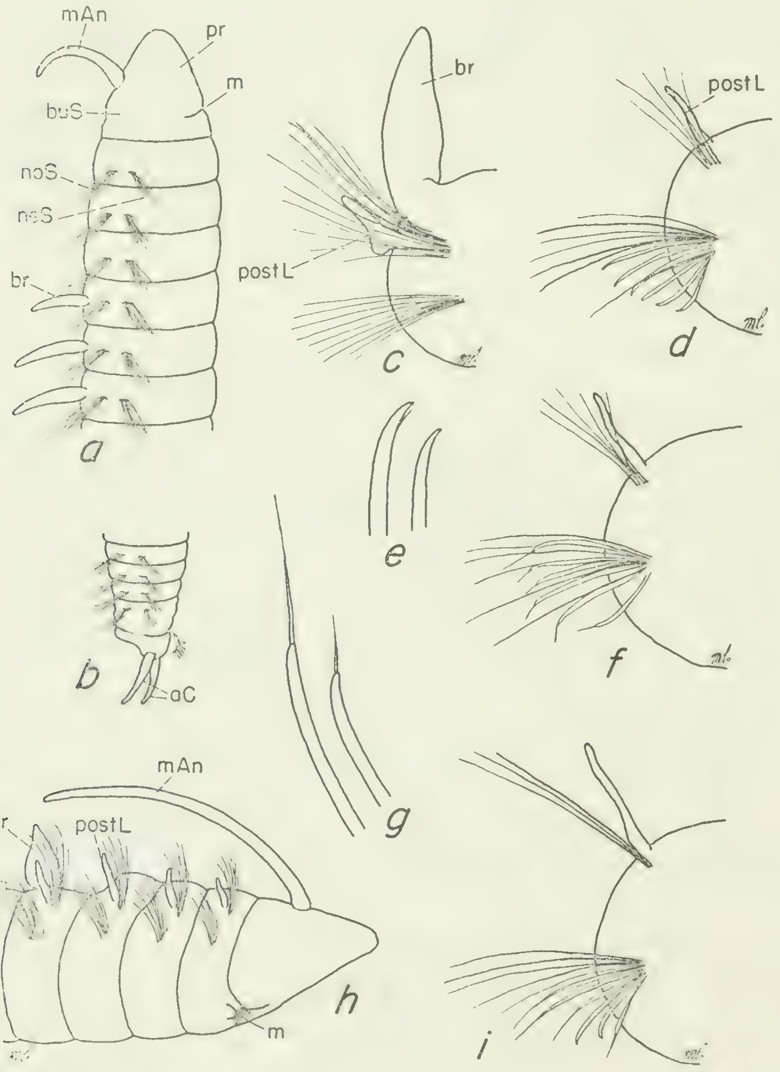

FIGURE 80.—Paraonidae, *a–e*, *Aricidea jeffreysii: a*, lateral view anterior end; *b*, same, posterior end; *c*, branchial segment; *d*, posterior segment; *e*, neuropodial crotchet. *f–g*, *Aricidea suecica: f*, posterior segment; *g*, neuropodial crotchets with mucronate tips. *h–i*, *Aricidea quadrilobata: h*, lateral view anterior end; *i*, posterior segment.

BIOLOGY.—Dredged on bottoms of soft mud and sandy mud. They are evidently bottom-deposit feeders; sand grains were noted in the gut. Females distended with numerous medium-size white eggs (massed in postbranchial region, eggs not as large as in *A. jeffreysii* or *A. suecica*) were found in Maine in August (Ebenecook Harbor, August 10, 1955) and in Massachusetts in July (Massachusetts Bay, July 27, 1953) and August (Cape Cod Bay, August 26, 1954).

MATERIAL EXAMINED.—Maine (Middle Cove and Love's Cove, Ebenecook Harbor, Southport Island, 3–7 fathoms), Massachusetts (Cape Cod Bay, 14–27 fathoms; Massachusetts Bay off Plymouth, 12–17 fathoms).

DISTRIBUTION.—Maine, Massachusetts. In 3 to 32 fathoms.

Aricidea (Aricidea) albatrossae Pettibone, 1957c

FIGURE 81

? *Aricidea fragilis* McIntosh, 1885, p. 354, pl. 43, figs. 4, 5, pl. 22*a*, fig. 18.—Not Webster, 1879.

Aricidea (Aricidea) albatrossae Pettibone, 1957c, p. 354, fig. 1.

DESCRIPTION.—Length more than 15 mm., width up to 2 mm., segments more than 54. Anterior end greatly flattened. Prostomial antenna short, subulate, extending back to first setiger. Branchiae 26–30 pairs, straplike, with short slender tips. Notosetae and neurosetae of posterior region few, slender, capillary, inconspicuous.

BIOLOGY.—Dredged in deep water in grey, green, or blue mud and ooze.

MATERIAL EXAMINED.—Off Massachusetts to off Chesapeake Bay, *Albatross* stations, 788 to 1,395 fathoms.

DISTRIBUTION.—Deep North Atlantic, off Massachusetts to off Chesapeake Bay. In 788 to 1,395 fathoms.

Aricidea (Aricidea) jeffreysii (McIntosh, 1879)

FIGURE 80,*a–e*

Aricidea nolani Webster and Benedict, 1887, p. 740 (part).

Aricidea jeffreysii Fauvel, 1927, p. 75, fig. 25,*a–c*.—Berkeley and Berkeley, 1950, p. 55, fig. 3.—Southward, 1956, p. 269.—Hartman, 1957, p. 322.—Eliason, 1962, p. 261.

? Not *Aricidea jeffreysi* Renaud, 1956, p. 26, fig. 18,*a–e*.

DESCRIPTION.—Length up to 20 mm., width up to 1.5 mm., segments up to 120. Prostomial antenna short, filiform to clavate, often projecting anteriorly or extending back to first setiger. Branchiae usually 13 pairs (11–22), straplike, tapering gradually to pointed tips. Notosetae of posterior region few, slender, capillary. Neurosetae of posterior segments of 2 kinds: (1) Long, slender, capillary setae and (2) shorter, stouter, slightly hooked crotchets with a faint sheath, up to 5–8 in number arranged in transverse row (fig. 80,*d*,*e*).

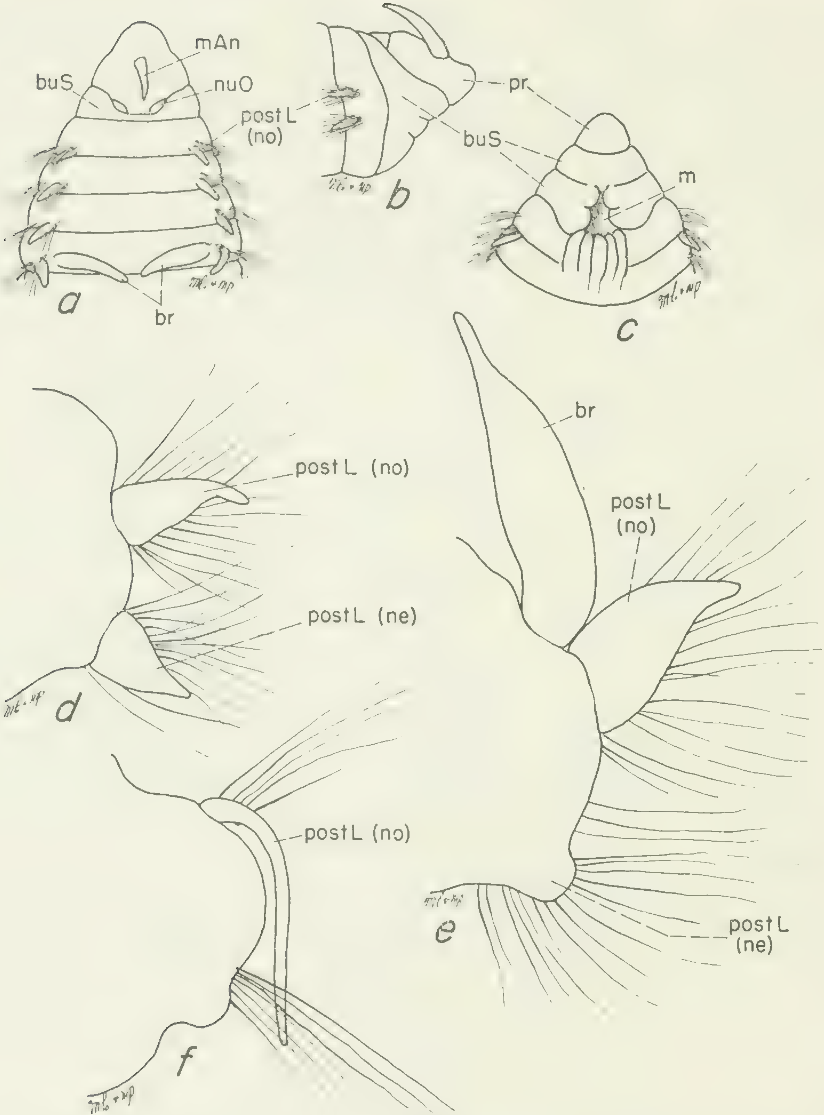

FIGURE 81.—Paraonidae, *Aricidea albatrossae: a,* dorsal view anterior end; *b,* same, lateral view; *c,* same, ventral view; *d,* right parapodium from first setiger, posterior view; *e,* same, from setiger 7; *f,* same, from postbranchial segment.

Proboscis bulbous or cylindrical, ciliated. Color, in life: greenish yellow on prostomium and anterior segments; in alcohol: brownish, especially anteriorly; may be brownish banded posteriorly.

BIOLOGY.—Dredged on bottoms of coarse to fine sand, sticky and soft mud, ooze, muddy sand, sand or mud with gravel, shells, tubes. Females massed with large yolky coral-pink eggs and males with white sperm masses found in Massachusetts in July (Cape Cod Bay, July 8, 1954). Found in the stomach of haddock (Georges Bank, 1953, R. Wigley).

Material examined.—Gulf of St. Lawrence (Prince Edward Island), Maine (Middle Cove, Ebenecook Harbor, Southport Island, 1–3 fathoms; north end Long Ledge, Sheepscot River, 3 fathoms), New Hampshire (Portsmouth Harbor, 2 fathoms), Massachusetts (Georges Bank, 40–84 fathoms, R. Wigley; Cape Cod Bay, 12–29 fathoms; Massachusetts Bay off Plymouth, 10–17 fathoms; Buzzards Bay), deep Atlantic (*Albatross* Station 2192, 39°46′ N., 70°14′ W., 1,060 fathoms, 1884; Station 2217, 39°47′ N., 69°34′ W., 924 fathoms; Station 2231, 38°29′ N., 73°09′ W., 965 fathoms; Station 2234, 39°09′ N., 72°03′ W., 810 fathoms).

Distribution.—Ireland, Denmark, Mediterranean, Davis Strait to off Long Island Sound, Florida?, western Canada (Gulf of Georgia). In 1 to 1,060 fathoms.

Aricidea (*Aricidea*) *suecica* Eliason, 1920

Figure 80,*f*,*g*

Aricidea nolani Webster and Benedict, 1887, p. 741, pl. 7, figs. 97, 98 (part).
Aricidea suecica Eliason, 1920, p. 52, figs. 14–15.—Wesenberg-Lund, 1950a, p. 32, pl. 8, fig. 35; 1950b, p. 79; 1951, p. 73; 1953, p. 60.—Southward, 1956, p. 269, fig. 21*d*.—Hartman, 1957, p. 318.

Description.—Length up to 20 mm., width up to 1 mm., segments up to 110. Prostomial antenna subulate or fusiform, usually curved dorsally and posteriorly, extending to setiger 2. Branchiae usually 15–19 pairs (10–24), straplike, tapering gradually to pointed tips. Notosetae of posterior region few, slender, capillary. Neurosetae of posterior segments of 2 kinds: (1) Some upper ones much elongated (longer than body width) and (2) lower ones shorter, slightly stouter, with long mucronate tips; some of the latter group may lack the mucronate tip). Without color, in life and in alcohol.

Biology.—Dredged on bottoms of mud and ooze, muddy sand, silty clay, mud with gravel, rocks, sand dollars, shells, and tubes. Females with large white eggs (massed in postbranchial segments) found in Maine in August (Ebenecook Harbor, August 2, 1955).

Material examined.—Gulf of St. Lawrence (Gaspé Bay, Bay of Chaleurs, 5–60 fathoms), Maine (Middle Cove and Love's Cove, Ebenecook Harbor, Southport Island, 3–7 fathoms; north end Long Ledge, Sheepscot River, 3 fathoms), Massachusetts (Georges Bank, 72–190 fathoms, R. Wigley).

Distribution.—Greenland, Jan Mayen, Iceland, Faroes, Sweden to British Isles, Denmark, Davis Strait to Massachusetts, Russian Arctic to southern Alaska. In 3 to 1,254 fathoms.

Family Trochochaetidae, new name (=Disomidae and Disomididae)

Type genus: *Trochochaeta* Levinsen, 1883; =*Disoma* Oersted, 1843, preoccupied; see p. 309.

The family, as defined by Mesnil, included *Disoma* Oersted and *Poecilochaetus* Claparède. I am following Hannerz (1956) by considering Poecilochaetidae as a separate family. Although they show similarities, both genera differ sufficiently to regard them as belonging to separate families. Both families show relationships to the Spionidae, the 3 families, then, forming a well-defined group among the spioniform polychaetes.

Body long, slender, cylindrical or somewhat flattened anteriorly, fragile (posterior end often missing in collections). Prostomium simple, elongate oval, wedged between or more or less encased in first 2 setigerous segments, usually with a median crest extending back on first setiger, with or without a small median occipital antenna, with or without 2–4 small eyespots, with a pair of very long, extensible tentacular palps which are longitudinally grooved along sides facing the mouth. Tentacular palps attached at base of prostomium, break off very easily and often missing, of various lengths, probably in different stages of regeneration (fig. 82,*a–c*).

Body divided into 2–3 more or less distinct regions, changing gradually and with transitional segments:

(1) Anterior or thoracic region (of about 9–20 segments, figs. 82,*a–c*; 83,*a–i*) with biramous parapodia. First 4 setigers modified. First tentacular or buccal segment with biramous parapodia projecting anteriorly, with bundles of long capillary notosetae and neurosetae, with triangular postsetal lobes (sometimes referred to as tentacular cirri); segment enlarged ventrally forming lips around large triangular mouth. Second segment with similar notopodial and neuropodial postsetal lobes, with or without notosetae. Neurosetae in form of slender capillary setae and heavy acicular setae or the neurosetae may not be specialized. Ventrally second segment forms lower lip of mouth. Third segment with neuropodia with dark heavy acicular spines and few capillary setae in vertical series. Notopodia with capillary setae. Postsetal lobes short, broad, oval or flattened, with border entire or serrated. Thus setiger 3 and sometimes setiger 2 with specialized heavy projecting acicular spines. Rest of thoracic segments with fan-shaped bundles of slender, pointed notosetae and neurosetae which may be spiny or hairy (fig. 83*e*). With additional stouter lanceolate neurosetae with hairy sheaths (fig. 83,*f,g*) or curved neurosetae with

hairy limbate borders (fig. 83*k*). With oval or platelike postsetal lobes with border entire or serrated (sometimes referred to as dorsal and ventral cirri). Notopodial lobes gradually get smaller posteriorly.

(2) Middle or anterior abdominal region (fig. 82*d*) with uniramous parapodia, with notopodia lacking. Neuropodia in form of simple, elongate-conical lobes with few heavy projecting acicular setae and slender tuft of long pointed setae, with a postsetal lobe and sometimes with a subpodal thin flange extending posteriorly forming a thin pouchlike membrane with frilled margin. Ventrally on body sometimes with 1 to few pairs short retractile papillae, more conspicuous posteriorly (sometimes referred to as branchiae).

(3) Posterior abdominal region (fig. 82,*c,f*) similar to anterior abdominal region except parapodia are biramous, with notopodia present in form of low mounds armed with a bundle of few acicular setae. When notosetae are extended, they appear as stellate or wheel-like structures (the structure to which the family name refers). Posterior end with collarlike pygidium or may be papillate. Proboscis an eversible, voluminous, lobulate soft sac, without jaws (fig. 82*c*).

The trochochaetids live in muddy bottoms and form long cylindrical tubes of fine mud particles held together by a fibrouslike secretion. They evidently form additional tubes more or less continuously. They are probably bottom deposit feeders.

Contains only one genus.

Genus *Trochochaeta* Levinsen, 1883

Disoma Oersted, 1843; preoccupied by Ehrenberg (1831, in Protozoa); type (monotypy): *Disoma multisetosum* Oersted, 1843.

Thaumastoma Webster and Benedict, 1884; type (monotypy): *Thaumastoma singulare* Webster and Benedict, 1884; = *Trochochaeta multisetosa* (Oersted, 1843).

Nevaya McIntosh, 1911; type (monotypy): *Nevaya whiteavesi* McIntosh; = *Trochochaeta multisetosa* (Oersted, 1843).

Disomides Chamberlin, 1919; type (author's designation): *Disomides multisetosum* (Oersted, 1843).

Type (monotypy): *Trochochaeta sarsi* Levinsen, 1883 (=posterior end of *Disoma multisetosum* Oersted, 1843).

Key to the New England Species of *Trochochaeta*

1. Notopodial and neuropodial postsetal lobes of some anterior segments serrated or fimbriated (figs. 82,*a–c*; 83,*c–d*) . . . . **T. multisetosa**
   Notopodial and neuropodial postsetal lobes of anterior segments with border entire, not serrated (fig. 83*j*) . . . . **T. watsoni**

Trochochaeta multisetosa (Oersted, 1843)

FIGURES 82, 83,*a–g*

Disoma multisetosum Oersted, 1843, p. 41; 1844, p. 107, pl. 2, figs. 1–12 (anterior fragment).—Eliason, 1920, p. 59.—Thulin, 1921, p. 9, figs. 7–17.—Wesenberg-Lund, 1950a, p. 31, pl. 7, figs. 31–32; 1951, p. 73.—Uschakov, 1955, p. 284, figs. 101–102.—Hannerz, 1956, p. 141, figs. 51–52.

Trochochaeta sarsi Levinsen, 1883, p. 129, pl. 2, figs. 6–7 (posterior fragment).

Thaumastoma singulare Webster and Benedict, 1884, p. 737, pl. 7, figs. 85–94 (anterior fragment).

Nevaya whiteavesi McIntosh, 1911, p.149, pl.5, fig. 1,*a–h*.

Spionid larva D. Thorson, 1946, p. 97, fig. 50,*a–d* (see Hannerz, 1956, p. 146).

Disoma franciscanum Hartman, 1947a, p. 16, figs. 1–3.

REMARKS.—*Thaumastoma singulare* was described from a single incomplete and rather mutilated specimen, the family of which was not determined. Mesnil (1897), using the original description and figures, referred it to *Disoma multisetosum*. Because of discrepancies in the descriptions, Hartman (1947a) thought it advisable to regard *Thaumastoma singulare* as an indeterminable genus and species. On the basis of a study of the slides of the type specimen in the U.S. National Museum, I have concluded that Mesnil was correct in referring it to *Disoma multisetosum*. The original description and figures are misleading in that the second setiger was not distinguished from the first; thus the stout spines referred to on the so-called first segment were those of the second segment; the two segments are close together and easily confused. The so-called median cirrus of the first segment was probably the prostomial caruncle or crest (not available for examination). The slides of the parapodia, from setiger 5 on, show some of the stouter penicillate acicular neurosetae in addition to the capillary neurosetae, evidently overlooked by Webster and Benedict.

Disoma franciscanum Hartman (1947a) was said to differ from *D. multisetosum* in the absence of a long cirrus on the third parapodium as shown by Oersted (1844, fig.11). The cirrus-like structure shown on the figure is confusing; it may refer to the upper lobule of the fimbriated notopodial postsetal lobe, which is often larger and may be set apart somewhat from the other lobules (it was previously pointed out by Mesnil that Oersted confused the dorsal and ventral sides of the animal). In examination of the types of *D. franciscanum*, I was unable to detect any embedded acicula such as those figured by Hartman (1947a, fig. 2,*a,d*).

DESCRIPTION.—Length up to 90 mm. or more, width up to 5 mm., segments up to 200. Body long, subcylindrical, anterior thoracic region wider, flattened dorsoventrally, rest of body flattened ventrally, arched dorsally, tapering gradually posteriorly. Body fragile, breaking up easily. Prostomium (fig. 82,*a–c*) elongate oval, wedged between parapodial lobes of first setiger, anterior two-thirds flattened, may ex-

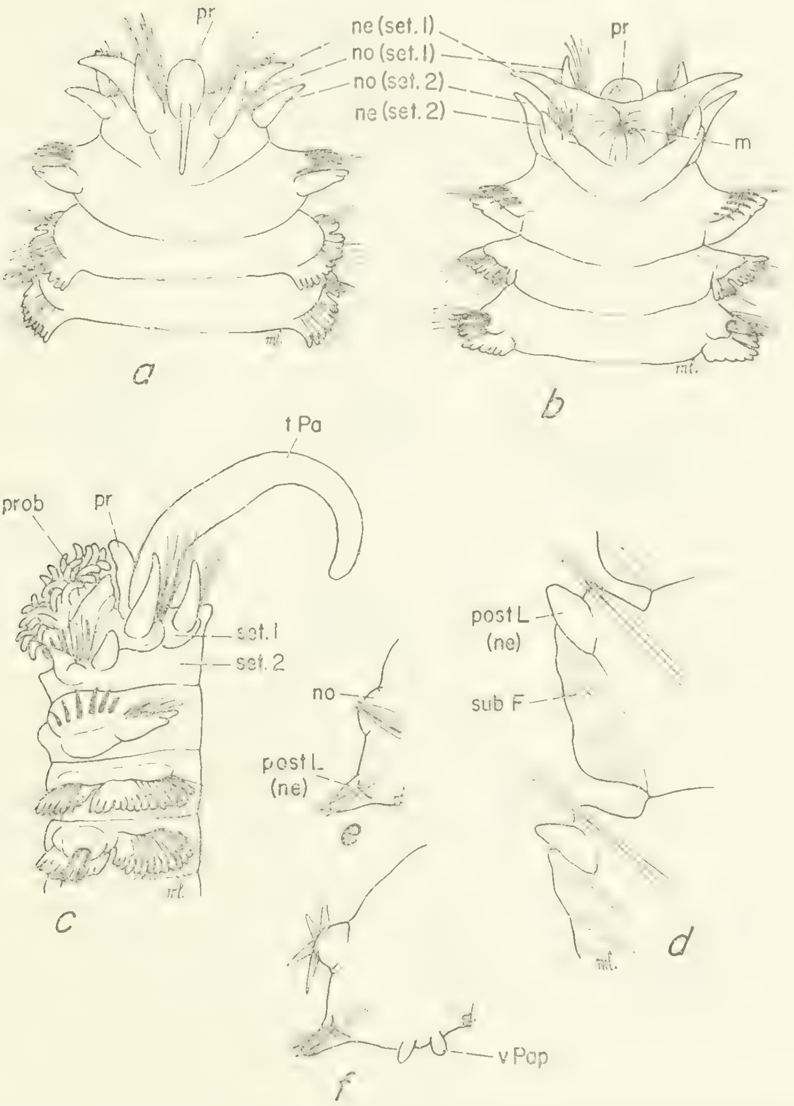

FIGURE 82.—Trochochaetidae, *Trochochaeta multisetosa:* *a*, dorsal view anterior end, tentacular palps missing; *b*, same, ventral view; *c*, lateral view anterior end with proboscis extended; *d*, 2 parapodia from middle or anterior abdominal region, dorsal view; *e*, parapodium from posterior abdominal region, with notopodial acicular setae withdrawn; *f*, same, with notopodial acicular setae extended.

tend down ventrally, flexible and variable in shape, rounded anteriorly. Posterior part convex, with 2–4 small inconspicuous eyes, with longitudinal crest extending posteriorly on first setiger as a narrow caruncle, without distinct antenna. Paired tentacular palps often missing, attached between base of prostomium and first setiger, large, cylindrical, extensible, with longitudinal groove along side facing the mouth. Large triangular mouth on ventral side of first setiger. Pro-

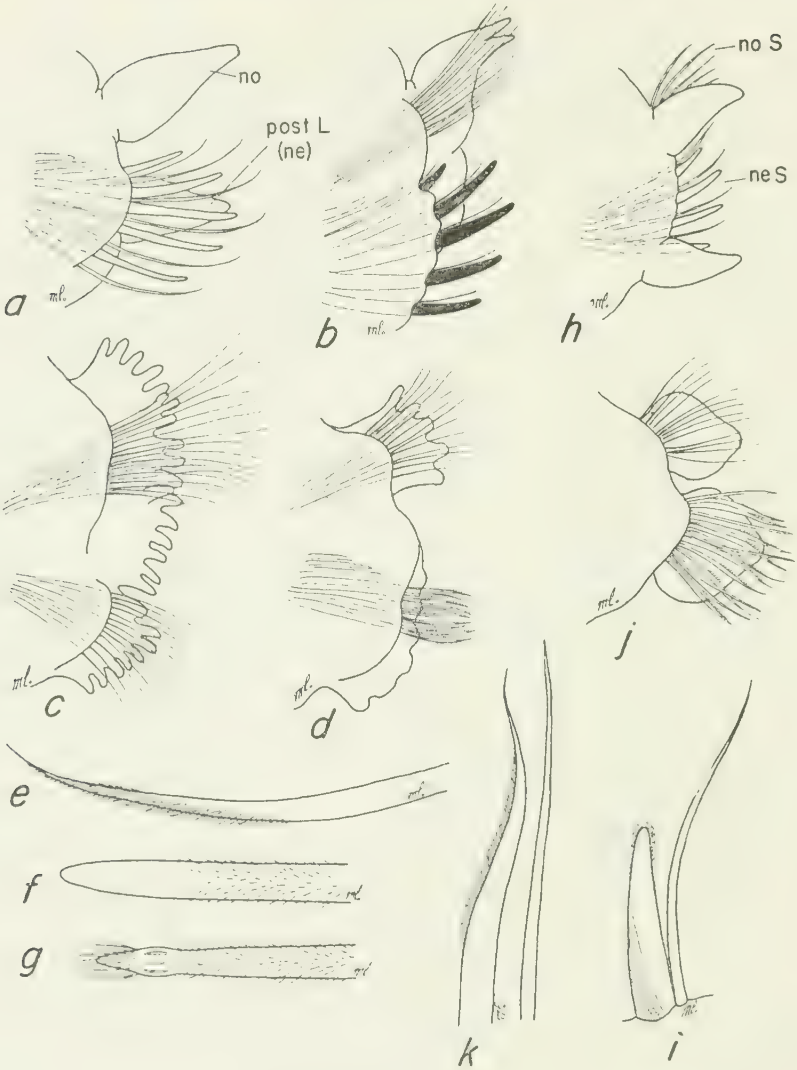

FIGURE 83.—Trochochaetidae, *a–g*, *Trochochaeta multisetosa:* *a*, thoracic parapodium from setiger 2, anterior view; *b*, same, from setiger 3; *c*, same, from setiger 4; *d*, same, from setiger 7; *e*, limbate, hairy capillary neuroseta from same; *f*, worn penicillate acicular neuroseta from same; *g*, penicillate acicular neuroseta from thoracic region of young specimen (Cape Cod Bay). *h–k*, *Trochochaeta watsoni:* *h*, thoracic parapodium from setiger 3, posterior view; *i*, neurosetae from same; *j*, thoracic parapodium from setiger 5, anterior view; *k*, neurosetae from same.

boscis protrusible as a voluminous, thin-walled lobulate sac with numerous short dicotymously branched lobes, with surface densely ciliated (fig. 82*c*).

Anterior thoracic region consisting of about first 20 segments (in larger specimens; 16 segments in small specimen from Cape Cod; 9 segments in young metamorphosed benthonic stage; see Hannerz, 1956, fig. 52). First 2 setigers with parapodia closely allied and directed anteriorly. First setiger with notopodial and neuropodial postsetal lobes conical, directed anteriorly. Neurosetae form a spreading bundle of short to long setae, slender, capillary, directed anteriorly. Notosetae capillary, shorter, fewer and finer than neurosetae. Second setiger (figs. 82,*a–c*; 83*a*) with parapodia ventral to those of the first segment, not completely visible when viewed dorsally. Notopodial and neuropodial postsetal lobes projecting anteriorly, similar to those of first segment but shorter. Notosetae lacking. Neuropodia directed anteriorly, with comblike row of 5–6 shorter, stout, light to dark yellow acicular neurosetae ending in blunt tips, alternating with longer, slightly more slender neurosetae tapering to fine tips (the acicular neurosetae are evidently replaced, as 2–6 acicular neurosetae in various stages of formation are buried in the parapodial lobe; the neurosetae of the second setiger must be formed rather late as they were not found in the recently metamorphosed young specimen, according to Hannerz).

Setiger 3 (fig. 83*b*) with parapodia projecting laterally. Notopodia with fan-shaped bundle of slender capillary notosetae, with broad digitate postsetal lobe, the upper lobule usually larger and may be somewhat set apart from the others. Neuropodia with a comblike vertical series of 4–6 heavy dark slightly curved acicular spines alternating with very slender, shorter capillary neurosetae (evidently the acicular spines are replaced as there may be 2–6 additional acicular spines in process of formation buried in the lobe). Neuropodial postsetal lamella broad, serrated. Setiger 4 (fig. 83*c*) with a spreading bundle of slender capillary notosetae and a greatly expanded serrated notopodial postsetal lobe, which may appear nearly continuous with the smaller serrated neuropodial postsetal lobe. Neurosetae slender, slightly limbate, with fine tips, shorter and slightly stouter than notosetae.

Beginning on setiger 5 (fig. 83*d*), notopodia with spreading bundles of capillary notosetae, with serrated postsetal lobes (fewer serrations than on setiger 4). Neuropodia with cylindrical setal lobes, with serrated postsetal lobes. Cylindrical bundles of neurosetae of two kinds: (1) 6–15 shorter, stouter, lanceolate acicular neurosetae toward the center of bundle, tapering to blunt tips, with a hairy sheath which may be variously frayed or worn, the so-called penicillate acicular neurosetae (fig. 83,*f*,*g*); (2) numerous, longer, curved neurosetae with hairy limbate borders, tapering to fine tips (fig. 83*e*). In addition to the exposed neurosetae, there may be numerous acicular neurosetae buried in the lobe in various stages of development, each with a pubescent sheath. Evidently the acicular neurosetae are replaced constantly; it has been suggested by Thulin (1921) that they function in tube construction.

In the rest of the thoracic region, the parapodia are modified gradually, the setae becoming fewer in number, the notopodial postsetal lobes become smaller with fewer lobules, finally becoming a single digitiform lobe. The neuropodial postsetal lobes with fewer lobules, finally with a single digitiform postsetal lobe.

Middle or anterior abdominal region (fig. 82*d*) uniramous, lacking notopodia entirely. Neuropodia cylindroconical, with few slender, slightly hairy capillary neurosetae and 1–2 projecting acicular neurosetae, usually one of which is more exposed, with tip blunt, the other one with just the fine tip exposed (in younger specimens, both taper to long fine tips), with single digitiform postsetal lobes and, developing gradually, with subpodal thin, slightly undulate lamellar membranes or flanges extending posteriorly to the next septa.

Posterior abdominal region (fig. 82,*e*,*f*) differing from anterior abdominal region by the addition of notopodia which develop gradually in the form of small rounded, slightly conical low mounds equipped with few (4–7), acicular dark yellow spines. Notopodial spines short, wider basally, tapering to sharp tips; when withdrawn, only the dark tips are exposed; when extended, they form a characteristic stellate cluster (it has been suggested by Hartman that they may function for traction in the tube). Beginning on about setigers 20–40, with small, cylindrical and retractile ventral papillae on either side of the midventral line, situated on a slightly raised area; they are more conspicuous in the posterior region, 1–4 papillae per area (fig. 82*f*; they have been referred to as branchiae; Hartman has suggested that they may be sensory). Posterior end with thick collarlike pygidium with border slightly lobulate or with 4 distinct lobes in younger specimens. Young specimen transparent, white.

Tube long, cylindrical to somewhat flattened, flaccid, fragile, easily broken. It may be up to 165 mm. long, 6 mm. in diameter, complicated with anastomoses and free branches (Thulin). Wall formed of fine mud particles cemented together by longitudinally arranged fibers secreted by the worm. Without membranous lining. Thulin has suggested that the tube building is aided by the penicillate acicular neuropodial setae of the thoracic region.

BIOLOGY.—They are dredged on bottoms of fine sand, mud, including blue mud, black foul-smelling loose mud, mud with algae, *Zostera*, and stones. They live in mud tubes of their own making and are probably continually in the process of tube building. Sexually mature adults have been found in April in Swedish waters (Hannerz). The eggs are discoid, whitish, with thick egg membranes and membrane vesicles (21–32 at the edge, Hannerz, Hartman). The early development is not known but it is probably entirely pelagic. Advanced ciliated larvae have been found in the plankton in Swedish and Danish waters in March to July, most numerous in April and May, when they may be the dominating polychaete larvae in the plankton (Hannerz, 1956; Thorson, 1946, as spionid larva D); the larvae are predominantly planktotrophic.

Hannerz followed the development of the advanced planktonic larvae to the metamorphosed young benthonic stage, when they built a tube of mud particles and a secretion (thoracic region with 9 biramous segments; abdominal region with 13 uniramous segments, with 4 anal cirri; they swim in doubled up position, folding at the transitional region). The larvae are characterized by the outspread shield or "umbrella" formed by the coalesced prostomium and peristomium. The tentacular palps are formed relatively late, the right one characteristically longer than the left one. The larval setae of the first setiger are especially long.

Material examined.—Type slides of *Thaumastoma singulare* Webster and Benedict from Cape Cod, Massachusetts; types of *Disoma franciscanum* Hartman from central California. Single small specimen from Cape Cod Bay, 21 fathoms. Many empty tubes, perhaps of this species, dredged in Cape Cod Bay. Two specimens from Gulf of St. Lawrence (Bay of Chaleurs, 11–15 fathoms).

Distribution.—West Greenland, Faroes, Iceland, Swedish and Danish waters, western Baltic, Gulf of St. Lawrence to Massachusetts, central California, north Japan Sea. In 1 to 370 fathoms.

Trochochaeta watsoni (Fauvel, 1916)

Figure 83,*h–k*

Disoma watsoni Fauvel, 1916, p. 1, fig. 1,*a–i;* 1932b, p. 28, pl. 1, figs. 8–11.

Description.—The species was described originally from a single anterior fragment of 9 segments. Two anterior fragments, the largest of 32 segments, are referred to this species (collected by the *Albatross*). The original description is supplemented to some extent but the species is still incompletely known.

Length?, width up to 2 mm., segments more than 32. Thoracic region wider, somewhat flattened dorsoventrally, anterior abdominal region narrower, cylindrical. Prostomium fusiform, rounded anteriorly or may be slightly notched, with a longitudinal crest extending posteriorly on first setiger, with or without occipital antenna (absent according to Fauvel; present on one specimen, indistinct on the other; perhaps it may be broken off). Tentacular palps not observed but oval scars between base of prostomium and notopodia of first segment indicate their places of attachment. Notopodial and neuropodial postsetal lobes of first 2 segments lanceolate, directed anteriorly on each side of prostomium, subequal, with a fan-shaped group of setae directed anteriorly and surpassing the prostomium, the notosetae more slender than the neurosetae, all ending in capillary tips. On setiger 2, the notosetae are present as a distinct group. The neurosetae form a wide fan-shaped bundle of arched stouter and shorter setae, tapering to short fine tips (Fauvel indicated some were subacicularlike; none seemed to be specialized as acicular spines as in *T. multisetosum*). Ventrally large mouth with lateral and lower lips formed by first two setigerous segments.

Setiger 3 (fig. 83,*h*,*i*) with fan-shaped group of slender capillary notosetae and a comblike row of neurosetae consisting of 4–6 stout curved acicular spines alternating with slender capillary setae. Notopodial and neuropodial postsetal lobes elongate-ovoid. Setiger 4 with longer capillary notosetae. Neurosetae shorter and slightly stouter than notosetae, tapering to fine tips. Notopodial postsetal lobes cordiform. Neuropodial postsetal lobes wider and shorter, oval.

Setigers 5 to 9 make up rest of thoracic region (fig. 83,*j*,*k*). Notopodia with fan-shaped bundles of numerous capillary notosetae, straight or slightly curved, smooth or very finely spinous. Neuropodia with fan-shaped bundles of numerous setae of two kinds: (1) long, thin, doubly curved, very finely spinous neurosetae with capillary tips; (2) 5–8 stouter neurosetae occupying center of bundle, curved, tapering to slender tips, widely limbate on curved part, with striated or hairy border. Postsetal lobes globular to cordiform.

Middle or anterior abdominal region begins on setiger 10, with notopodia absent, with few transitional neuropodia. Neuropodia form conical lobes, with neurosetae consisting of few (1–3), heavy, hairy projecting acicular setae and few, slender, hairy capillary setae. Neuropodial postsetal lobes digitiform and with subpodal undulate thin flanges extending posteriorly to following septa.

BIOLOGY.—Found in deep water on bottoms of fine mud.

MATERIAL EXAMINED.—Off Massachusetts (*Albatross* Station 2076, 41°13′ N., 66° W., 906 fathoms, blue mud (two anterior fragments).

DISTRIBUTION.—Off Nova Scotia to off Massachusetts. In 740 to 906 fathoms.

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